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THE METAL INDUSTRY

WITH WHICH ARE INCORPORATED
THE ALUMINUM WORLD: COPPER AND BRASS: THE BRASS FOUNDER AND FINISHER
ELECTRO-PLATERS REVIEW

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Vol. 19 NEW YORK, NOVEMBER, 1921 No. 11

The British Institute of Metals

Meeting in Birmingham (England)—Part 1

Written for The Metal Industry by Our British Correspondent

The Institute of Metals was founded in 1908 as the result of a movement initiated in Manchester and warmly taken up in Birmingham, where the inaugural meeting was held. In holding its autumn meeting in Birmingham this year the Institute therefore was paying a return visit to its birthplace. Starting with about 250 members, the Institute's roll now contains over 1,400 names. General meetings for the discussion of papers are held in May and in the autumn of each year, and researches of great service to the metal industry, for instance, on corrosion, are carried out in the intervals by Committees of the Institute. By the formation of Local Sections which hold monthly meetings during the autumn and winter the continuity of the work of the Institute is further secured, and discussions of service both to local manufacturers and to metallurgical research and industry generally are carried on. Birmingham almost from the first has had its Local Section. Glasgow, London, and Sheffield have within the last few years followed its example and other centres are in course of formation.

Not only as a metallurgical center, but also as a pioneer city of England in matters of education; and particularly technical education, with a progressive University exceptionally well equipped for dealing with the applications of science, and particularly metallurigical science, to industry, Birmingham might be regarded an exceptionally suitable place for the meeting of the Institute of Metals. The meeting proved one of the most successful of the series. The Reception Committee had for its chairman, Sir Gerard Muntz, Bart, (a former President of the Institute) and for its honorary secretary Mr. G. W. Mullins, Director of the Cold Rolled Brass and Copper Associations. About 500 members and visitors were provided with instruction and entertainment.

The Lord Mayor (Alderman W. A. Cadbury) at the opening of the business meetings in the Municipal Technical School on Wednesday, September 21st, gave the Institute a civic welcome, and in the evening hospitably received the members and their friends in the City Art Gallery and Museum. On the same day a luncheon was given by the Metal Trades Federation, comprising all the associations in the copper, brass, nickel silver, aluminum and silver trades. A Garden Party was given on the Thursday by the Reception Committee at the Botanical Gardens and during days of the Conference many local works were visited. On the Friday, a motor excursion was made to Kenilworth, Warwick and Stratford-on-Avon, with tea at Tiddington House, the seat of Sir Gerard Muntz, Bart.

FIRST SESSION

The President, Eng. Vice-Admiral, Sir George C. Goodwin, K. C. B, LL.D., took the chair, and after acknowledging the Lord Mayor's speech of welcome said that the Institute during its absence from Birmingham had grown enormously, and they were very glad to come back to a city which was known as the center of non-ferrous work of all kinds. A large proportion of the scientific work of the country was done in the University and technical schools of Birmingham, and everyone was aware of the very large amount of practical application to the service of the nation of the knowledge which was imparted at such institutions.

NEW OFFICERS

The following were nominated by the Council and accepted by the members as officers for the ensuing year: President, Mr. Leanord Sumner of Manchester; Vice-presidents, Sir John Dewrance, Sir William E. Smith and Professor T. Turner; Members of Council, Mr. William Murray Morrison, Sir Charles A. Parsons, Mr. H. A. Rick-Keene, Mr. A. E. Seaton (Hon. Treasurer) and Mr. James Stephen.

NEW DEVELOPMENTS

An invitation was accepted from the Institution of Mechanical Engineers to take part in a joint discussion on October 21st upon some of the light alloys of aluminium. A suggestion from Mr. G. W. Mullins that in future a lecture should be given at the autumn provincial meeting on some subject connected with the work of the district concerned was approved. The proposal was that the lecture be given by a competent lecturer and should appeal not only to the scientific members of the Institute but also to the workers of the district. The President added that the Council proposed to interpret the term "workers" in the broadest possible sense, because they were all workers in non-ferrous metals.

NICKEL-ALUMINIUM-COPPER ALLOYS

The first paper taken was that on "The properties of some nickel-aluminium-copper alloys" by Professor A. A. Read, D. Met (Cardiff), and R. H. Greaves, M. Sc. (Woolwich). The paper was presented in abstract by Mr. Greaves.

ABSTRACT

In some of the copper-rich nickel-aluminium-copper alloys the alpha solution will retain much more nickel and aluminium at 900° C. than at ordinary temperatures. Alloys typical of the region comprised between the limits

of composition of the alpha solution at 900° and at ordinary temperatures have been examined. These alloys, while relatively soft on quenching from 900°, are hardened by slow cooling from that temperature or by reheating to lower temperatures. This change is the result of the appearance of a new constituent (probably a nickel-aluminium-copper solid solution), the separation of which is accompanied by changes in the density and electrical conductivity of the alloy in addition to its effect on tensile, hardness, notched bar, and other tests.

The separation of this special constituent takes place somewhat slowly, so that chill-cast alloys and hot-rolled rods of small section consist almost wholly of the alpha constituent. The cold-rolled rod, obtained by hot-rolling followed by a few passes in the cold, thus consists almost wholly of the alpha constituent.

On annealing the cold rolled alloys, softening proceeds very slowly up to 500°, at which temperature precipitation of the nickel-aluminium rich constituent begins to take place at an appreciable rate, with the result that with some compositions a progressive increase of hardness is obtained by holding the alloy at 500° C. If the separation is sufficient this may more than counterbalance the previous softening, giving an alloy of high elastic limit and tensile strength and good elongation (*e. g.*, a maximum load of over 50 tons per sq. in. with an elongation of 20 per cent.).

The rate of cooling from a temperature above that at which the alpha solution begins to deposit the special constituent has a great influence on the mechanical properties of the heat-treated alloys. The hardest product is, however, obtained by reheating the quenched alloy for some time at 600° to 700° C. (say, two hours at 600°, or ½ hour at 700°). The alloys so treated generally give better properties than are obtained by any uniform rate of slow cooling (*e. g.*, yield point over 20 tons per sq. in., maximum load over 40 tons per sq. in., elongation about 15 to 25 per cent.).

The heat-treated alloys show considerable endurance under alternating stresses above their true fatigue limit, the determination of which involves a number of prolonged tests.

DISCUSSION

Dr. Rosenhain in opening the discussion said that very great interest attached to that particular alloy in relation to hardening and tempering, and apparently the effect was very similar to what was found in other alloys, and notably in steel. There were a large number of alloys in which hardening could be obtained by quenching and tempering, and he thought a great deal of progress was to be looked for as the result of future researches in that direction.

Miss Marie Gayler asked a number of questions as to the measurements, times, and other procedure in the experiments dealt with by the authors. It was stated, she remarked, that the specimens were quenched after an hour's annealing at 900° C. In that case, she thought the alloy would be in equilibrium before measurement took place. Then, the specimens apparently were cooled from 900° to 700°. It would be interesting to see whether annealing for any number of hours brought out greater hardness than slow cooling to 700°. It appeared to her that the annealing temperature throughout was rather high because in nearly all cases the compound had to be precipitated.

Dr. Hatfield (Sheffield) challenged the conclusion that "in the quenched alloys the fatigue limit is about 2 tons per square inch above the load giving a permanent extension of ½ per cent in the tensile tests." He thought that the experimental evidence from which that conclusion was drawn should be very carefully reconsidered.

Mr. Greaves in reply said that the authors did no tests at all below the temperature of 300° and the maximum time over which the tests were carried out was three or four days. At lower temperatures the tests would have to be prolonged considerably to give satisfactory results. In reply to Dr. Hatfield, Mr. Greaves called attention to the statement in the paper that similar behavior had been observed in other materials. That statement he believed, was perfectly correct.

EFFECT OF LEAD IN GUN-METAL

Mr. R. T. Rolfe, F. I. C. (W. H. Allen, Sons & Co., Ltd., Bedford), gave a resumé of his paper "The effect of increasing proportions of lead upon the properties of Admiralty gun-metal."

ABSTRACT

The effect of lead upon Admiralty gun-metal has been studied by the production of synthetic alloys containing gradually increasing proportions of lead up to 1.68 per cent., subject to control as regards compositions, casting temperatures, and general conditions. Sand and chill-castings were produced, while a duplicate set of determinations were made on re-melts of the original alloys, thus checking the results from these and affording information on the variations in composition and properties caused by re-melting.

In sand-cast gun-metal, lead gradually increases the strength, ductility and softness of the alloy up to about 1.5 per cent. of lead, but above this proportion causes a decrease in all three. Maximum repeated-impact resistance is obtained with 1 per cent. of lead, falling-away when this figure is exceeded. Lead does not affect the soundness, and is microscopically readily detectable on either the plain polished or etched surfaces.

In chill-cast gun-metal, these effects are rather masked. The effect on the hardness parallels that of the sand-cast metal, with a change-point at about 1.5 per cent. of lead, but associated with a minimum rather than a maximum strength figure. Increasing lead proportionately decreases the ductility and also the impact-figure of the metal twice melted, that melted once giving more irregular results. Lead does not affect the soundness and is microscopically readily detectable on the plain polished surface.

The influence of lead on liquation, machinability, corrosion and behaviour for bearing purposes is also discussed, and it is suggested that in sand-cast gun-metal, the proportion of lead permitted by the Admiralty specification might with advantage be increased from 0.5 to 1 per cent.

An appendix deals with the influence of increasing proportions of lead upon the properties of gun-metal containing copper 85%, tin 5%, zinc 10%.

DISCUSSION

Dr. F. Johnson (Birmingham Municipal Technical School) said that Mr. Rolfe's attitude towards arsenic had completely changed, judging by a comparison of the present with former papers of the author. Whereas formerly Mr. Rolfe gave about 0.3 per cent. as the maximum permissible in gun-metal, he now said that arsenic up to 0.5 per cent. caused no particular falling away in quality. The increase in the hardness of the bar at a point corresponding to the presence of about 1.5 per cent. of lead, Dr. Johnson thought might be due to an increase in the relative proportion of eutectoid owing to a change in the ratio of tin to copper on the replacement of the copper by the lead.

Mr. J. S. Glen Primrose (Ipswich) suggested that the conflicting opinions quoted by Mr. Rolfe might not be found to show such wide discrepancies if the several conditions of casting and use of the gun-metal were more fully explained or known. The author assumed that the presence of 0.5 per cent. of arsenic would not mask the

effect of the lead addition, but the speaker thought it would be preferable to make sure on that point. These two elements together might quite possibly have an effect which either alone would not have. The interesting instance of lead segregation mentioned illustrated the difficulty of finding by analysis all the lead intentionally added to gun-metal or any other highly cupriferous metal. A slow-speed butterfly drill should be used. With a high speed twist drill the sides of the hole very frequently got smeared with liquated lead and thus a low result was given.

The President, referring to the statement in the paper that from the view-point of strength and ductility there appeared in the case of sand castings no justification for the limiting in the Admiralty specifications of the lead content to 0.5 per cent., remarked that that was rather a strong thing to say. From the point of view of the Admiralty there was a justification for the limit which was adopted on the strength of experiments carried out by members of the Institute. The reason was that gun-metal fell off very much in ductility at high temperatures, and as the tendency in marine engineering was to employ higher and higher degrees of super-heat the limitation became more and more important. They might have 0.5 per cent. of lead without injuring the mechanical properties but they should not go beyond that. That was the advice given by prominent members of the Institute of Metals who had given attention to the subject†.

Mr. Rolfe, replying on that discussion explained that when he said that there was no particular falling away in the results that was to be attributed to arsenic he was simply making a comparison with the normal alloys mentioned in the paper. In the alloys containing 0.3 per cent. of arsenic he saw no falling off in the results, but only an improvement, and this could be attributed to the lead. A falling off might be expected when the arsenic exceeded something like 0.3 per cent. As the paper stated, the ductility of normal alloys with 0.5 per cent. of arsenic was decidedly inferior to that of the normal alloy free from arsenic. With regard to Mr. Primrose's suggestion that gases absorbed in the melting would considerably affect the tensile strength by causing unsoundness, there was no question of unsoundness at all in the alloys dealt with. The effect of lead in improving the casting was usually seen in sand castings and not in chill castings, and this had made it necessary for qualifying the general statement as to lead causing improvement. Mr. Reason had spoken of the improvement in strength and ductility obtained by remelting. Taking a long series of experiments, this result was not consistently obtained and sometimes a falling away in both qualities was found. With regard to the Admiralty specifications, he would not for a moment impugn the wisdom of limiting lead in such cases as the President had mentioned. The Admiralty specification, however, was often applied to metal for ordinary commercial purposes and the restriction was unnecessary, in his opinion, except where super-heat was one of the working conditions.

This report will be continued in our December issue.—Ed.

The Magnesium Alloy "Electron"

(Communication from the Research Department, Woolwich)†

By S. BECKINSALE, B.Sc., A.I.C. Member

Several samples of German origin, of the magnesium alloy known as "electron" have recently been examined, and the following brief account of its properties may serve to amplify information lately published about high magnesium alloys.* The specimens were in the form of cylindrical rod 0.3 in. in diameter.

CHEMICAL ANALYSIS.

	A.	B.	C.
Copper per cent	0.20	0.42	0.62
Zinc per cent	4.62	4.24	4.37
Magnesium per cent (by difference)	95.18	95.34	95.01
Tin, manganese	nil	nil	nil
Lead, iron, aluminium	trace	trace	trace

SPECIFIC GRAVITY.

A.	B.	C.
1.78	1.79	1.79

Brinell Hardness Tests (1 mm. ball; 10 kg. load).

	A.	B.	C.
Exterior surface	51	51	63
Transverse section	50	48	59

Tensile Tests. Diameter of test-piece, 0.180 in. Elongation measured on 0.64 in. ($=4\sqrt{\text{area}}$).

	A.	B.	C.
Yield point (by dividers), tons per sq. in.	12.0	7.6	12.0
Maximum load, tons per sq. in.	16.1	18.0	18.4
Elongation per cent	19	19	13
Specific tenacity: $\left\{\frac{\text{Maximum load in tons per sq. in.}}{\text{Weight of 1 cub. in. in lbs.}}\right\}$	250	278	284

Compression Tests on Cylinders, 0.310 In. Diameter; 0.310 In. Long.

	A.	B.	C.
Yield point, tons per sq. in. (compression, 0.5 per cent. with load on)	3.0	6.0	8.4
Permanent reduction in length at—			
Loads of 10 tons per sq. in., per cent	3.9	2.0	1.0
Loads of 20 tons per sq. in, per cent	10.1	9.1	7.0
Crushing load, tons per sq. in. Fracture occurred by shearing	23.0	22.3	23.9

Microscopical Examination.—All samples showed equi-axial polyhedral crystals of a single solution. One end of sample C, which had been headed, showed distortion of the grains; these were elongated in the direction at right angles to the axis of the rod.

The specimens were polished on fine emery-paper impregnated with paraffin wax followed by selvyt, to which a little metal polish had been applied. The specimen, to which a trace of polish adhered, was then transferred to clean selvyt.

A satisfactory etching agent was a solution of 1 per cent hydrochloric and 0.5 per cent nitric in alcohol.

Machining properties of the alloys were very satisfactory, and a good finish was produced by shaping or turning. It may be remarked that on account of the danger of fire the manufacturers issued very strict regulations to prevent the accumulation of turnings beyond a certain amount in the factories where these alloys were machined.

SUMMARY AND CONCLUSIONS

The samples of "electron" examined contained about 95 per cent of magnesium, 4.5 per cent of zinc, and 0.5 per cent of copper. They were in the form of rod, probably extruded at a raised temperature; one sample showed evidence of having been subjected to cold heading. The alloys machined well, and compared very favorably with aluminium alloys in tensile properties (allowance being made for the much lower specific gravity), but they were not so ductile in compression.

*"Magnesium and Its Alloys." . . . Engineer, 1919, vol. cxxvii, p. 402. T. Blackwood Murray (Presidential Address to the Institute of Engineers and Shipbuilders of Scotland), THE METAL INDUSTRY, 1920, vol. xvi, p. 512. "The Casting of Electron Metal," ibid., 1920, vol. xvii, p. 107. "Metallic Magnesium," ibid., 1921, vol. xviii, p. 426.

†Read at the meeting of the British Institute of Metals, Birmingham, England, September 21-22, 1921.

The Casting of Brass Ingots[1*]

(Communication from the Research Department, Woolwich)

By R. GENDERS, M.B.E., B.Met., A.I.C., Member (Woolwich)

During the examination of large numbers of specimens of hollow-drawn articles made from 70:30 brass rod which were subjected to expansion of the walls in manufacture, and later in service, it was found that where failures occurred, whether during manufacture or in service, they were due almost exclusively to the presence of inclusions of non-metallic matter which must have originated in the casting of the ingot. The surface of the burst or split in the wall was generally discolored or black, and transverse sections through portions below the split invariably disclosed the responsible defect. Such an inclusion, radial in direction and connected with cracks, is shown in Fig. 1.

It has been found that defects similar to those in articles made from rod by drawing very seldom cause failure

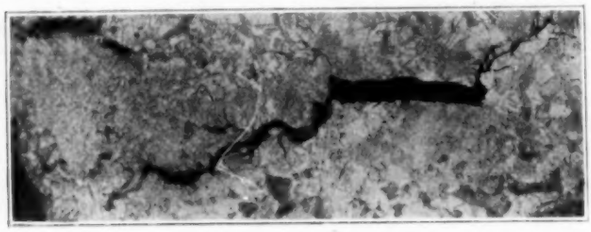

FIG. 1. CRACK DUE TO NON-METAL INCLUSION

in tubes and similar articles, such as cartridge cases, which are drawn from a disc. This would not be unexpected. In the rolling of an ingot to rod any defects, such as inclusions of non-metallic matter, would be elongated to an extent depending on the relative cross-sections of the ingot and the rod. Laterally, the defects may have their largest dimension in any direction, depending on the original position in the ingot and the manner in which the rolling has been done, but there is no doubt that a large proportion of defects are approximately radial in the finished rod and remain so throughout manufacture. Non-metallic inclusions have no useful strength and, in their effect on the mechanical properties of the metal, amount practically to areas of discontinuity. Thus an inclusion, radial in the wall of a tube, reduces the effective thickness of the wall by an amount equal to its radial length, and further, probably acts as a notch from which a crack may start on expansion of the tube. When the ingot is made into strip by rolling, any defects present are elongated in the form of plates in planes parallel to the surfaces of the strip. In the cupping operations such defects would be also distorted into cup form and finally drawn into the walls of the tube as thin plates running circumferentially and concentrically with the inside and outside surfaces.

Such forms are not particularly undesirable when the finished product is solid, but where a hollow article, subject to expanding stresses in use, is to be made, the avoidance of inclusions of foreign matter is vital, and the form of ingot requires considerable modification. The long narrow ingot mould leads to splashing, and the solidification of the metal is very rapid, leaving no time for the rising of trapped dross, etc. The pipe forms rapidly and is steep and narrow, and the intermittent replenishment with molten metal during solidification results in the enclosing of the foreign matter on the surface of the previous depression.

In experiments which were carried out to minimize the occurrence of non-metallic inclusions, the first step taken was to adopt a form of ingot whose length was not great in proportion to the cross-sectional area. The ingots made were 3 in. square and 30 in. in length, as compared with the ingots 6 to 7 ft. in length and 1½ in. square section in common use. Steel-making practice was followed in introducing a hot sinking head or "dozzle." The dozzle (a short fireclay sleeve) is heated to the melting furnace temperature and inserted in the top of the mould, resting on a small ledge. A sketch showing the arrangement is shown in Fig. 2. The molten brass is poured through the dozzle, which is filled to the top. No pipe is formed in the ingot proper, the metal in the dozzle remaining quite fluid and sinking gradually, with level surface, to feed the contraction of the ingot below. Additions of metal may be made at any time to the metal in the dozzle without risk of introducing defects into the ingot, any dross rising to the top of the still fluid head. The dozzle is thus an automatic feeder, ensuring that the top portion of the ingot is free from piping defects. There is no need to discard any of the top end of the ingot beyond the metal which has finally solidified in the dozzle.

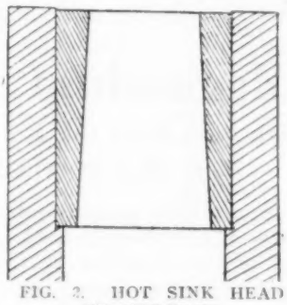

FIG. 2. HOT SINK HEAD OR "DOZZLE"

It was found later that these experiments were undertaken at about the same time as the introduction of dozle feeding for flat cartridge case ingots by Barclay.*

Central shrinkage cavities were avoided by regulating the rate of pouring so that the ingot, when just completely poured, had a fair temperature gradient from bottom to top. This necessitated a rate of pouring much below that for the normal foundry practice, and where two ingots were poured from one pot the cooling in the crucible of the metal for the second ingot was appreciable. To overcome this difficulty the moulds were tapered, to the top being enlarged by increasing amounts in successive experiments, and ingots were cast at the usual foundry speed. It was found that with a mould 3½ in. square at the top, tapering to 3 in. at the bottom, no shrinkage cavities were formed and the ingot appeared to be practically perfect as regards soundness. The use of a tapered ingot results in either a tapered strip or the necessity for a certain amount of edge rolling. Its adoption, however, appears to be justified by the greater certainty with which sound ingots can be produced.

A further refinement which the author would like to see adopted in non-ferrous foundries is the use of a ladle and bottom pouring. This method has been adopted with considerable success in one particular works, for the manufacture of articles in which non-metallic inclusions are to be avoided. It is fully recognized that in a great many cases economic considerations would render such methods as the use of short broad tapered ingots with dozzle feed beyond reach, but cases have come under the author's notice where, had it been recognized that the avoidance of non-metallic inclusions was of primary importance and the costlier methods adopted, such methods would undoubtedly have proved more economical than the endless replacement of wasters in manufacture and rejection.

[1]Read at the meeting of the British Institute of Metals, Birmingham, England, September 21-22, 1921.

*THE METAL INDUSTRY, May 2, 1919.

Synthetic Mechanics

The Mechanics Who Are Just Slapped Together, but with Their Minds Omitted

Written for The Metal Industry by WILLIAM H. PARRY

It does not follow that because a young man has served his time at any of the mechanical trades that he is a mechanic, if he has not been taught or has not acquired the habit of thinking. Purely mechanical skill will carry a man just far enough to earn some kind of a living, but it won't make him a top-notcher.

How often it happens in all shops for alleged mechanics to trot over to the foreman's throne for instructions of the simplest character, because of their inability to think for themselves. This breed of men I brand as synthetic mechanics, because they lack the spark that makes the difference between an able man and an indifferent workman.

In all trades there are certain hard and fast rules that govern the making of various parts, and in many instances no improvement seems to be possible in these processes, but every now and then some thinker refuses to be bound by these rules and breaks away from them, to the everlasting benefit of his trade. Synthetic mechanics are always satisfied to follow along prescribed lines, which generally means those of least resistance.

A great naval architect, Mosier by name, who was responsible for the design of many of our speed-boats of the "Say When—Now Then" type, some thirty years ago, had been on a still hunt for years for a patternmaker who would follow instructions in making screw propeller patterns. He claimed that he had met but two kinds of pattern makers, those who could not follow his instructions and those who would not if they could Ordinarily the blue print is supposed to supply all necessary data bearing on screw propellers, just as it does on all other classes of work, but this man wanted to see the job grow under his personal supervision, and brought the job to a shop where I happened to be employed at the time.

He proceeded to scare everybody stiff in his preliminary remarks as to what he wanted, and made such an impression on our boss by his vehement denunciations of the past performances of our fellow-craftsmen that he (the boss) decided to tackle the job himself, and not trust us ordinary slobs. He was not prompted by any desire to shine as a super-mechanic (though he was one), but he dearly loved to take down men who thought they knew it all.

After inviting the naval architect to make himself comfortable on top of a tool-chest (there were no other seats in that shop), he proceeded to make his layout, in this case full-sized. The architect fussed and fumed at what he considered a waste of good time, but in the end, and to his everlasting credit, be it recorded, he was satisfied that he had met one man who could make a screw propeller properly, and in about one-fourth of the time taken by the synthetic type.

This man sat on the tool-chest for part of one day only, as on the second day things were happening so fast that it kept the yacht designer up on his toes to follow the successive operations which were bewildering to his mind. He had become so accustomed to pattern-making of the prescribed kind, that it was hard to realize that he had at last met a man who needed no instructions as to how a job should be made, and would not have paid any attention to them anyhow, as his thinking apparatus was at least three jumps ahead of that possessed by any salt-seat ship designer.

A pattern-maker was once given the job of making a pair of hinges for the land-end of a yacht clubhouse runway. They were ponderous affairs, and sizes did not matter much, but speed did. This poor fish must have thought he was working on a watch, but he didn't think so long, as, after spending half a day on the job, he was relieved of further participation in its making by the foreman handing it over to an apprentice to finish, explaining to the journeyman that he feared that the yacht owners would hardly be able to place their boats in commission that season if somebody did not finish the job.

One of the greatest mechanics I ever met was a green sand floor molder who was so illiterate that his serious reading was confined to the pictures in the Police Gazette. Nevertheless he was a thinker, and a profound one, more than able to hold his own with the best educated mechanics, and his judgment was given the deference due to a really great molder.

And after all is said and done is there any better field for a young man to enter today, than that of the foundry, be it either steel, iron, or brass? The opportunities are limitless, if our boys could be induced to take the work seriously, or, in fact, take to the trade at all. There is altogether too much striving for the high collar jobs among our youth today, and one glimpse of a foundry's interior is an instant cure for any lurking ambition to shine as a molder. That is where the synthetic mechanic gets in his fine work, as he will not allow his son or sons to take up the molder's trade, on the ground that the vocation is not a desirable one from an æsthetic standpoint, when as a matter of fact it was good enough to provide him with a means of making a living in spite of his rank incompetence.

There are too many synthetic mothers abroad in the land today, who are afraid that their boys may dirty their lovely hands while being taught a trade, and who are unduly shocked at the filth in evidence on the persons of their cream puff sons after one day's work in a foundry. Hence the declaration that they did not bring up their sons to be "mud diggers."

There is a trade school in Brooklyn, N. Y., that advertises in the local papers that they are in the market to prepare pattern-makers to leave the ranks of syntheticism by a course of tuition on work that does not usually fall to the lot of many journeymen, and in so doing, they are great benefactors to the trade. There are altogether too many graduates from pattern shops who, during their apprenticeship, have never had the opportunity to become skilled in a wide variety of work .

Journeymen are not entirely at fault for not being able to tackle any old job handed to them, as in a great many shops it is the custom to entrust the best class of pattern-making to those best fitted to handle same, which, of course, is eminently proper and profitable, so, that the only way left to the apprentice to acquire the knack is by making a noise like a sponge and act the part of absorbing everything and giving forth nothing, unless squeezed by a desire not to be known as a synthetic mechanic.

American Electro-chemical Society

The Fall Meeting at Lake Placid, N. Y., September 29-October 1

It was generally conceded by all in attendance at Lake Placid that a most unique meeting place had been selected for a Fall meeting. Through the courtesy of the Lake Placid Club their recreation facilities were placed at the disposal of the members and afforded excellent opportunities for taking part in golf, tennis, motoring and mountain hiking.

A great deal of the success of the meeting is due to Mr. W. M. Corse, who spared no effort as acting chairman of the arrangement committee.

On Thursday, September 29, at 9 a. m., the fortieth general meeting of the society was called to order by President Acheson Smith, who then introduced Dr. Melvil Dewey, founder and president of the Lake Placid Club. Dr. Dewey cordially welcomed our members and mentioned several points of interest that every one should see while at Lake Placid. The reading and active discussion of papers followed this talk and were continued in the mornings of the next two days, the features of which were respectively the Symposiums on Non-ferrous Metalturgy and Electrodeposition.

TECNICAL SESSIONS.

Each of the three technical sessions was attended by a number of members and guests who took active part in discussing the papers presented. The result was that the proceedings, carried out according to schedule, were lively as well as interesting.

The Thursday morning session was filled by reading and discussion of papers:

Experiences with Alkaline and Alkaline Earth Metals in Connection with Non-Ferrous Alloys. Charles Vickers. Sodium appears to have a negative value for copper, but seems to be superior to phosphorus in deoxidizing bronze. Calcium, of the alkaline earth metals, appears valueless in producing sound copper castings. As a deoxidizer, calcium is best adaptable when combined with an acid element, as silicon, and is further improved when combined with a third element.

The Electrolytically Produced Calcium-Barium-Lead Alloys Comprising Frary Metal. W. A. Cowan, L. D. Simpkins, and G. O. Hiers. This paper presented by Mr. Hires described the development of Frary metal and its production by electrodeposition from a mixture of calcium and barium chlorides over a bath of molten lead as cathode. The properties of Frary metal are compared with those of other bearing metals. As a bearing metal it has desirable hardness and strength at elevated temperatures.

The Electrolytic Corrosion of Lead-Thallium Alloys. Colin G. Fink and C. H. Eldridge. Presented by Dr. Fink. Anodic corrosion losses in an acid copper sulfate electrolyte containing nitric and hydrochloric acids are reduced by using lead-thallium alloys. A minimum loss of 1.2 lb. per 100 lb. of copper deposited resulted with a lead anode containing 10 per cent Tl and 20 per cent Sn.

A New Theory of the Corrosion of Iron. J. Newton Friend. An auto-colloidal catalytic theory, which postulates the corrosion as starting by the formation of colloidal ferrous hydroxide. This by contact with the air forms hydrated ferric hydroxide which in turn is alternately reduced by contact with iron and oxidized by contact with air, thus continuing the corrosion.

SYMPOSIUM ON METALS

Friday morning was devoted to a Symposium on Non-ferrous Metallurgy. The papers included were:

The influence of the Electric Furnace on the Metallurgy of Non-Ferrous Metals. H. M. St. John. The use of the electric furnace in brass foundries and refining plants for melting purposes has revolutionized metal handling methods; a more uniform quality of product is obtained with less labor and less metal wastage. The attainments are better than have been previously possible and the secretiveness which has been characteristic of the non-ferrous industry is gradually being done away with.

Modern Developments in the British Brass Industry. E. A. Smith. The actual condition of the British brass industry is presented with a discussion of electric brass furnaces, hot pressing and forging of brass, rolling mill practice, annealing, etc.

Resistance Type of Electric Furnace in the Melting of Brass and Other Non-Ferrous Metals. T. F. Baily. The various features to be considered in making an electric furnace installation for melting non-ferrous metals are discussed.

Comparison of Electric Furnace Practice with Fuel Fired Furnace Practice. N. K. B. Patch. The author's experiences are that the cost of metal melted, the melting losses, and the solution of gases in metal, are substantially the same in the electric and the fuel fired furnace, provided intelligent operation is pursued.

Electric Silver Melting. H. A. DeFries. Describes advantages of electric furnace melting of silver and relates how a more ductile and tougher silver results upon introducing an iron block into the bath.

Electric Furnace Melting of Nickel-Silver. F. C. Thompson. Advantages of melting nickel-silver in the externally heated electric furnace are discussed.

Aluminum-Copper Alloys. R. J. Anderson. A discussion of the manufacture, properties and uses of the commercial aluminum-copper alloys employed in the United States.

Recent Developments in Electric Furnaces of the Muffled Arc Type. H. A. Winne. Several types of muffled arc melting furnaces are described with their features and adaptabilities.

Electric Furnace Purification of Zirkite. J. G. Thompson. The arc type furnace used in this investigation made it possible to remove 90-95% Si as an impurity from the Zirkite ore; the amount of carbon introduced being only sufficient to transform the silicon to the carbide.

Physical Characteristics of Specialized Refractories. Cross Breaking Strength at 20° and 1,350° C. M. L. Hartman and W. A. Koehler. The tests were carried out on each of ten refractory materials at the temperatures indicated.

ELECTRODEPOSITION SYMPOSIUM

An Electrodeposition Symposium was the feature of the morning of the closing day of the Meeting, Saturday, October 1. The papers discussed were:

The Effect of Pressure on Overvoltage. H. M. Goodwin and L. A. Wilson. The values of overvoltage of hydrogen against copper, nickel and mercury electrodes were determined at pressures varying from one atmosphere to a few centimeters of mercury.

Researches on the Electrodeposition of Iron. W. E.

Hughes. The results of several experimenters and those obtained by the author are related in the electrodeposition of iron from (1) sulphate solutions, (2) chloride solutions and (3) sulphate-chloride solutions.

Electrolytic Solution and Deposition of Copper. T. R. Briggs.

Electrometallurgy of Zinc. W. R. Ingalls. The developments in the electrolytic zinc extraction process and the progress, in Scandinavia, of electrothermic smelting are set forth.

Deposition of Zinc from the Zinc Cyanide Solution. C. J. Wernlund. This research was carried out with the intention of obtaining a zinc cyanide plating solution which would operate successfully under the most trying commercial conditions.

The Electrodeposition of Lead-Tin Alloys. Wm. Blum and H. E. Haring. That a finer grained deposit of alloys of lead and tin can be obtained from fluoborate solutions than is possible when depositing either of the metals under similar conditions is established.

The Structure and Properties of Alternately Electro-deposited Metals. Wm. Blum. If during the deposition of copper thin layers of nickel are interposed, a deposit of greater tensile strength than pure copper results due to the restraining influence nickel has on the growth of copper crystals.

Concentrates

Concentrates are pre-prepared alloys containing a much higher percentage of some constituent than is called for in the regular alloy. Phosphor copper, phosphor tin, manganese copper, nickel copper, silicon copper, etc., are examples of concentrates and carry much higher percentages of phosphorus, manganese, nickel and silicon, respectively, than are specified in a regular alloy.

Concentrates have in different respects an advantage. Frequently the constituent has an extremely high melting point which is lowered decidedly when mixed with some other metal like nickel in copper and manganese in copper. By using the concentrate as a medium of introducing the high-melting point metal we relieve the regular alloy of extreme temperatures and their attending evils. Again the concentrate may have a definite percentage of the constituent not otherwise likely to be realized in the alloy. This is true in phosphor copper, where in reputable brands the phosphorus content is stable. The practice of introducing phosphorus into the regular alloy in stick form is indefinite, wasteful and more or less unsafe. We never know how much of the phosphorus used will enter the metal or what amount will escape into the air. Manufacturers of phosphor copper are equipped and experienced to control these situations at minimum loss and maximum safety and efficiency. A further advantage is the greater likelihood of obtaining a better and more uniform mixture of the metals in the regular alloy.

On the liquid surface of copper-zinc alloys is a fine white powder in flaky form, known as zinc oxide. This substance, particularly in evidence at high temperatures and when the zinc and copper are directly combined, enters the pouring stream and is carried into the mold producing castings of roughened and wavy cope surface. In particular cases the evil can be considerably reduced by using a copper-zinc concentrate. In making brazing flanges from the alloy copper 86-zinc 14, a copper 72-zinc 28 concentrate was used and resulted in castings exceptionally fine in appearance and quality.

In this connection the value of yellow brass pipe and clippings is worth noting. They are practically a copper-zinc concentrate and represent the purest grades of these metals thoroughly alloyed. Their advantage in reducing the cost and bettering the quality of zinc—including alloys—is considerable. In using them, however, care should be taken to guard against any that might include aluminum.

In making concentrates the very best of furnace practice should be observed. When fusing temperatures vary widely as in nickel and copper, the furnace should be well pre-heated, the metals charged, covered with broken up charcoal and given such time and temperature as will insure complete fusion. The bath should then be thoroughly stirred and the metal at once pigged. Concentrates should be made in comparatively small rather than unduly large quantities. Large quantities often overtax even the limits of available temperatures and are otherwise difficult to manipulate. In a 500-pound furnace a charge of from 200 to 300 pounds shows better judgment than loading up to capacity. When copper is to be mixed with some metal of lower melting point,—zinc, for instance,—the copper should be first reduced and the zinc then added all under charcoal covering. Neutral fluxes such as charcoal, borax, salt, plaster of Paris, etc., are valuable in making concentrates but active fluxes or reagents such as phosphorus, zinc, silicon, magnesium, etc., are for most part inadmissible unless sanctioned by the alloy for which the concentrate is intended. Most concentrates of common usage are made and marketed by reliable manufacturers who by virtue of experience and equipment are specialists in their line. Their methods and quality are hard to duplicate in the ordinary foundry and it will generally be found better to buy than to try to make them.

R. R. CLARKE.

High Lead Bronze

The alloy of 65 copper, 25 lead, 5 tin is almost identical with the formula of the well-known "Plastic Bronze." This alloy is made successfully by a great many brass foundries without the use of any special additions. The addition of products containing nickel or phosphorus will lessen segregation of the lead, but they may cause hard spots, unless well diffused, hence they should be avoided if good results can be obtained without them.

The above alloy while it has a very good tensile strength and elongation, on the other hand has a very low elastic limit. This low elastic limit confines its successful use to small bearings where the pressures are low and the speeds not excessive. Where there is a heavy belt pull, where pressures per square inch are high or where there is pounding the "Plastic Bronze" is too soft and will be deformed. In cases where the bearings are pressed into steel housings and subsequently become heated in service, it is not unusual to find that this soft bearing bronze has been compressed to such an extent that the bearings are loose in the housings.

"Plastic Bronze" on account of its high lead content is liable to make drossy castings as the lead oxidizes very readily. By taking precautions to avoid this oxidation and by careful gating clean castings may be obtained. When clean, uniform casting are obtained the bearings are very satisfactory, as the antifrictional characteristics of the alloy leave little to be desired. On account of its plasticity shafts soon get a good seat and close fitting is thus unnecessary.—J. L. JONES.

Comparison of Electric Furnace Practice With Fuel Fired Furnace Practice

The Author's Experiences Are That the Cost of Metal Melted, the Melting Losses, and the Solution of Gases in Metal Are Substantially the Same in the Electric Furnace and the Fuel Fired Furnace, Provided Intelligent Operation Is Pursued[1]

By N. K. B. PATCH, Works Manager, Lumen Bearing Co., Buffalo, N. Y.

Our experience with electric furnace melting began with the installation of one Baily electric furnace early in 1916; later, a second was added and was followed by a third. The first Baily was used in melting our Lumen alloy— a zinc base alloy of relatively low melting point. It gave very satisfactory results from the first, and the other two have also worked out very well on alloys with higher melting point, such as phosphor bronze and manganese bronze. These furnaces are in daily operation.

In 1920 we added a Detroit rocking electric furnace with automatic electrode control. Our experience indicates that each electric furnace has its particular adaptability; that is, a Baily is to be preferred to the arc type of furnace, for the production of certain types of alloys, even though it consumes a larger wattage than the other types. It is also advantageous to use the arc type of furnace for other types of alloys, both because of the larger production as well as the lower cost.

It is entirely probable that experience will indicate the preferred application of each of the types of electric furnaces, the resistance type having a certain definite field, the arc type another and the induction type still a third field within which its success is most marked.

In comparing the cost of operating electric furnaces with fuel fired furnaces, of either the hearth type or the crucible type, many things must be borne in mind. The location of the plant with reference to a source of power is, of course, paramount. Obviously, cheap electric power will give the electric furnace a decided advantage. Located as we are in Buffalo, this first requirement is well provided for.

Next in order, it seems to me, is the efficiency of the combusion of the fuel in a fuel fired furnace. Where fuel is grossly wasted, electric furnaces will indicate an advantage, which is entirely unwarranted. Our oil consumption in our fuel fired furnaces is, we believe, as low as is the practice in any of the plants, so that in comparing our costs, both the electric and fuel fired furnaces are worthy of comparison.

Next in importance in considering costs is the relative cost of labor on the two types of furnaces. Neither type of furnace is fool-proof, and it is our experience that the greater capacity the furnace may have per hour, the greater intelligence is necessary in its operation. This is true in both types of furnaces.

In considering the advantages that each may have over the other, the outstanding advantage of the electric furnace is its cleanliness, and comfortable operating conditions. On the other hand, a fuel fired furnace still has a decided advantage over the electric furnace in the consideration of first cost. Our experience has indicated that after considering all items which make up the cost, such as fuel consumption, refractories, repairs, maintenance, wages to operators, etc., under the conditions under which we operate at low fuel cost, and low current cost, the cost per 100 pounds of metal melted is practically the same in either type.

The claims of the electric furnace manufacturers for marked saving in melting loss are somewhat exaggerated. It is true that certain types of alloys may be melted in an electric furnace with a reduction in this loss, as against melting the same alloy in inefficiently operated fuel fired furnaces. Properly operated fuel fired furnaces, however, will compare favorably on this score with electric furnaces.

The sensitiveness of non-ferrous alloys to the solubility of gases during melting is such that the atmosphere of any furnace must be carefully considered. The electric furnace more or less improperly handled is just as liable to cause trouble as the fuel fired furnace is, as the combusion of the electrodes, or resistance materials, is an ever present source of CO gas, which is readily soluble.

We, therefore, believe that any consideration of the relative advantages of the electric furnace as compared with the fuel fired furnace, both as to the standpoint of cost and quality of metal produced, resolves itself to the consideration of two prime factors —one the most of the current or fuel, and the other the intelligence of the operator. Given low fuel cost and low current cost, and satisfactory intelligence in operation in both cases, the one is no cheaper than the other, but the quality of the metal in some of the more sensitive alloys is more reliable in melting in electric furnaces. The reduction in the cost of rejected castings indicates an advantage in favor of the electric furnace, in our opinion, enough to compensate, in some degree, for the difference in the first cost of the equipment.

Alloys that are sensitive to hydrogen gas, superheated nitrogen and carbon should show marked improvement when melted in electric furnaces under intelligent control.

We have had no experience with the operation of induction electric furnaces, our remarks referring to other types. It is entirely probable that an induction type of furnace, through its entire absence of the superheated gas problem, offers a solution of the problem above mentioned, of the sensitiveness of the alloys to the solubility of many of the gases of combustion. There are, no doubt, inherent weaknesses in induction furnaces, which counterbalance to some extent this advantage.

It is difficult for us to give actual cost figures in regard to the above comparison, as we are manufacturers of brass castings from an extremely varied line of patterns, and a large number of different alloys. It is obvious that a jobbing brass foundry may be called upon to make castings from almost any alloy, and to almost any type of pattern. Such a condition must necessarily make cost comparisons of more or less doubtful value, since there are so many variables in the conditions which cannot be standardized, in order to make the comparison of any real value.

[1] Presented as part of a Symposium on Non-ferrous Metallurgy at the Fortieth General Meeting of the American Electrochemical Society held at Lake Placid, in the Adirondacks, September 29-October 1, 1921.

Modern Development in the British Brass Industry

A Discussion Is Given Embracing: Electric Brass Furnaces in England; the Extrusion, Hot Pressing and Forging of Brass; Rolling Mill Practice; Annealing; Composition of Industrial Brasses; and Treatment and Utilization of Scrap Brass—Part 1[1]

By ERNEST A. SMITH, A.R.S.M., M.Inst.M.M., British Non-ferrous Metals Research Assoc., Birmingham, England

A characteristic feature of modern industry is the preponderating part which scientific knowledge and methods play in its development. It is being increasingly recognized that one of the greatest factors in the progress of any branch of industrial activity is the extent to which scientific and technical knowledge is practically applied. This being so it is not too much to assert that the vigor and progressive spirit of an entire industry may well be gauged by the activity and growth of the industrial firms engaged in it, and that this will depend in no small measure on the extent to which the individual firms avail themselves of the scientific and technical knowledge relative to their industry which modern research has placed at their disposal.

The very exceptional claims made upon manufacturers during the war period caused them to seek the aid of scientific knowledge and guidance to an unprecedented extent, and led to developments that would have taken much longer to accomplish under normal industrial conditions.

In few cases has such development been more pronounced than in the brass industry. Time-honored practices based largely on empirical knowledge, have been subjected to the closest scrutiny and modified or discarded where found to be incapable of meeting the demands of modern industry. Viewing the industry as a whole one cannot fail to recognize a great step forward towards greater efficiency in plant and improved quality of product. Signs are not wanting that the British brass industry is now entering upon a new era in its long history.

The conditions of modern works practice necessitate a large amount of scientific control, not only of raw materials, intermediate products, and finished output, but also of methods and appliances used. This fundamental factor enjoys today greater recognition and fuller appreciation than ever before, but in spite of the considerable progress that has been made it must be admitted that not a few manufacturers still regard science and research as things belonging essentially to test-tubes and laboratory experiments, and remotely removed from everyday works practice.

For an industry, so long established and so largely built up on empirical knowledge, such as the brass industry, to reconstruct itself on a scientific basis is, however, no light task, but all impartial observers are agreed that this change which began some ten years ago is now proceeding at an accelerated rate.

The rapid progress that has been made in non-ferrous metallurgical research during the past few decades has placed at the disposal of manufacturers a considerable amount of new information relative to the materials employed in industrial art. Research has afforded a much deeper knowledge of the structure of metals and alloys, and a better understanding of the phenomena which are met in connection with their use in industrial practice.

A comparatively large proportion of this research has been devoted to brass and kindred alloys. While it must be admitted that some of this new knowledge is of doubtful practical utility, and in some cases even misleading, there still remains a considerable amount of reliable knowledge that is of the greatest value and practical importance, when placed in the hands of a trained staff capable of utilizing it intelligently.

An example of a great benefit to the brass industry derived from research is the electrolytic production of high-grade copper and zinc, both of which have done so much to improve the quality of brass products in modern times.

It would appear to be necessary to urge upon scientific contributors to brass literature to give to the manufacturers much fuller information than is usually done on the history of the materials used in their researches. For example, one comes across many papers in which figures are given for alloys of various tensile strength, yield point, elastic limit, elongation, reduction in area, etc., but in how very few cases is there a really adequate history of the material tested. We frequently have reports for instance on rolled brass in which no mention is made of the degree of cold work that has been put upon it, or what, if any, heat treatment has been given. The brass industry in particular suffers from this lack of essential information.

It is the purpose of this paper to indicate briefly the extent to which existing scientific and technical knowledge has been utilized in the British brass industry as a whole, and to describe the development that has resulted from its utilization.

WORKS LABORATORIES

Undoubtedly, in the past, one of the obstacles to the introduction of scientific methods has been the lack of works laboratories, which would serve not merely the purposes of analytical control, but also act as channels through which new knowledge could find its way into the works. As an intelligence department the laboratory is invaluable, but to fulfill its purposes fully it should be constantly on the look-out not only for new scientific knowledge, but also for improvements in technical details of production.

The demand for ever increasing efficiency in the founding and manufacture of brass has led to the introduction of methods of determining the qualities of the materials used to a much greater extent than was formerly considered to be necessary. Not only is it absolutely essential to have an accurate knowledge of the composition of the metals used for alloying purposes, but also to make careful physical tests of the metal during the various stages of manufacture. It is also considered highly advisable to test most of the other raw materials used in the foundry and in other departments of the works. Although much has been done in this direction there is still room for an extension of the system of putting the casting shop under the direct control of the laboratory, with an attempt to secure the most complete co-ordination.

The lack of laboratories is chiefly accounted for by the fact that in the brass industry as in other non-ferrous metals industries, there are comparatively few firms sufficiently large or wealthy to equip and maintain efficient up-to-date laboratories such as one finds in the steel industry. Groups of firms in association have established

[1]Presented as part of a symposium on non-ferrous metallurgy at the fortieth general meeting of the American Electrochemical Society held at Lake Placid, in the Adirondacks, September 29-October 1, 1921.

laboratories with suitable equipment, so as to be in a position to exercise more exact control of materials used, as well as of quality of products manufactured.

The first co-operative laboratory started in Birmingham in 1916 took the form of a small company, registered under the Board of Trade, and limited by guarantee. The equipment consists of a complete chemical laboratory fitted with every necessary appliance, together with a metallographic laboratory and appliances for physical testing and for pyrometric work. With such equipment many of the minor problems that present themselves in every-day works practice can be investigated and assistance given to the individual firm in whose works the difficulty arose.

MELTING AND FOUNDRY PRACTICE, COKE AND GAS FIRED FURNACES

Manufacturers are today more fully appreciating the fundamental importance of a sound ingot as the primary step to the successful and economic manipulation of the material in subsequent operations.

As H. B. Weeks has so well pointed out[2] "the architectural designs of a workship have much more to do with its efficiency than is generally supposed. Particularly does this apply to foundries where fumes, smoke, and dust are continuously mingling with the atmosphere in which the molders have to work. It is on that account, therefore, essential that spacious, well-lighted, well-ventilated, and lofty buildings should be erected for foundry purposes."

Many old brass foundries have been altered and remodeled as far as possible on modern lines, and newly erected foundries have been carefully planned with due consideration to the various factors mentioned. But much yet remains to be done to bring the foundries and melting shops of the brass industry as a whole to that state of efficiency in design and equipment, which is so essential to its future well being and progress. The substitution of up-to-date appliances for old, and the extension of labor saving devices are important factors in improved foundry production, and these factors are not being lost sight of where economic conditions are favorable to their adoption.

The furnace being of primary importance in foundry work has received a considerable amount of attention during the past decade. The old simple form of square coke-fired crucible furnace, almost universally in use at the beginning of the present century, has now been largely replaced either by improved types of coke-fired furnaces or by gas-heated furnaces. Whilst gas furnaces offer several important advantages over coke furnaces, and are being employed in increasing numbers for melting brass, it cannot truly be said that they are fully established for brass melting generally. The modified coke-fired crucible furnace is still the most generally employed for melting brass and other copper alloys.

The ordinary type of pit coke-fired crucible furnace has however been much improved and made more efficient by alterations in design, chiefly in the introduction of new forms of bottoms which permit of a more satisfactory supply and distribution of the air, which in some cases is preheated. A number of fire clay furnace bottoms have been patented, such as the Wigley, Edgar Allen, Hall, etc. A number of furnaces with bottoms of this type are in use, and are found to be much more economical and efficient and a great improvement over the old pattern furnace bottoms. Attention has also been given to the construction of the furnace lining and the quality of the material of which it is made. Another form of furnace in fairly general use is Carr's patent furnace, in which provision is made for retaining the heat by inserting non-conducting material in the furnace lining; special facilities are also made for a good supply of air, and for cleaning. As the brass foundry of Messrs. Vickers, Ltd., Barrow-in-Furness, there are forty-four crucible furnaces of a modified Carr type, which are stated to have contributed in no small measure to the success of the foundry work. Plumbago crucibles of 300, 200 and 150 lb. holding capacity are used.

With regard to gas fired crucible furnaces these have been applied to certain classes of brass melting in many localities where coal gas can be obtained for heating purposes at a reasonably low rate. Many types of gas furnaces having crucible capacities from 50 lb. to 800 lb. have been introduced for brass melting, and may conveniently be divided into two main classes according to the manner in which the gas is applied, viz.: low pressure furnaces and high pressure furnaces.

The low pressure type of furnace usually consists of pit furnaces and tilting furnaces with a crucible capacity of from 60 to 800 lb. which are employed for melting all classes of brass for the production of castings, ingots, billets, and strip and for melting scrap and swarf.

The high pressure tpe consists of pit furnace with a crucible, capacity varying from 60 to 200 lb. for melting brasses for strip and billets and for sand castings.

For this class of work furnaces fitted with atmospheric injector burners are generally used except where high speed of melting is required. Where gas furnaces have been introduced for brass melting they are chiefly of the low pressure type, as in the majority of operations there is no need to use high pressure gas.

In Birmingham, the centre of the British brass industry, the corporation has twenty miles of high pressure gas main laid and several brass founders in the city have adopted high pressure gas furnaces. A serious objection to all gas furnaces working under pressure is the noise, which is very trying to the melters and tends to militate against efficient production.

The author is in agrement with S. W. Brayshaw and others in considering that the future of gas melting furnaces lies not in high pressure gas, nor even with gas from the main, and air at 1 or 2 lb. pressure, but with ordinary gas and air at only a few inches of pressure not exceeding a 12-inch water column. This would mean an enormous cheapening of cost, owing to the economy of plant, since one would use merely a rotary fan. Such furnaces would be far less noisy to work.

It is now generally agreed that the working costs of the gas-fired furnace, under works and not test conditions, can be equaled by an ordinary well-designed coke-fired plant, and particularly by installation of the square-furnace type, such as have given good results in Birmingham and elsewhere. The advantages claimed for gas-fired installation, such as increase of output and longer life of crucible, appear to be offset in works practice by the breaking down of the furnace refractories under the influences of local heating of the latter in gas-firing, a lack of uniformity in heat distribution, and the risks of absorption of gas during melting operations. The pouring temperature has a great influence on the consumption of gas and another cause of wide difference in the melting figures for the same metal is its physical state. Thus the more finely divided the metal the more gas is required for melting. Usually ingots and heavy scrap are the easiest to melt whilst light scrap and swarf may require double or treble as much gas as ingots.

This article will be continued in our subsequent issues.—Ed.

[2]Journal Institute of Metals, 1920, 24, 76.

The Electro-Deposition of Iron

A Description of Plating of Iron for Steel-Facing, Electrotype Making and Repair Work*—Conclusion

By W. E. HUGHES, B.A.(Camb.), F.C.S., Mem. Inst. Met.

11. THE SULPHITE BATH

A great many baths founded upon sulphate of iron have been proposed. Each is considered to be the best by its "inventor." Many of them have been patented, though few would satisfy a Court of Law that they contained god subject matter. The element of novelty is usually conspicuous by its absence. A knowledge of the requirements of a good solution for depositing metals enables one to quite easily build up a bath suitable for the deposition of iron from the sulphates. The bath proposed by Dr. Schlötter[13] may serve many purposes.

(a) Composition and electrode reactions

(i). **Composition.**—Schlötter's solution contains:—

"Acid" ferrous sulphate.....150 gms.
Sodium sulphate .....100 "
and
Water .....1 lit.

No light is thrown upon what is meant by **acid** ferrous sulphate by the chemical textbooks. Any such special salt (if one exists) is not an ordinary article of commerce, and would certainly be expensive. It may safely be said that ordinary "green vitriol" can be used. The use of sodium sulphate may be advisable on several grounds. One of these is that it will perform the function of a "conducting salt"; another is that, at the concentration employed, the two salts may combine to form one salt which will give a complex anion containing metal (iron) as a component.[14] It is well known that solution containing such complex anions often give better deposits than solutions containing only simple ions. The silver, copper cyanide and nickel ammonium sulphate baths are examples. The double salt of sodium and iron is probably more soluble than the double sulphate of iron and ammonium, and hence the solution can contain a higher metal content. None the less, it has been shown many times that where the solution is worked at a high temperature (as in Schlötter's) the ammonium salt serves quite well. And again, so long as the metal content is high, the precise amount of iron salt used is immaterial. Schlötter states that the bath is to be maintained slightly acid. Herein lies one of the difficulties of working sulphate baths. They must be kept slightly acid if the best results are to be obtained from them; but the acidity must be slight only, and the difficulty is to maintain the proper degree of acidity. As will be shown later, acid very markedly affects the structure of iron deposits; moreover, any considerable acidity causes liberation of hydrogen, and thus leads to lower cathode efficiency. The point of special note is that *any* sulphate bath, made upon the lines of Schlötter's solution, one, that is, that is built up with the requisites of a good depositing solution in mind (high metal content, few kinds of ions, conductivity, and so on), will give good results.

(2). **Reactions.** The same general remark that was made above with regard to the reactions of the ferrous chloride bath apply here also. No scientific work has been done upon it,[15] and, therefore, one has to use observations and experience for the purpose of exercising control. Here, too, there is but little hydrogen evolution at the cathode: The main reaction is separation of iron. At the anode the reaction is mainly solution of the iron or steel of which this consists, for there is very little evolution of gas (oxygen), and the anodes dissolve well. Some functions of the sodium sulphate have already been mentioned. If the bath is made slightly acid (this time with sulphuric acid), the anode of efficiency will increase, but the cathode efficiency will decrease because more hydrogen will be evolved. A. Pfaff[16] maintains that the sulphate bath should have an acidity of 0.10N, if the deposition is to be long continued and the deposit is to remain smooth. The writer's experience is that much less acid is necessary, unless one wishes to secure unusually thick deposits—greater, that is to say, than some 0.01" to 0.015".

(1) Conditions of Deposition.—It seems to be generally agreed that the sulphate bath must be worked at a raised temperature. C. F. Burgess and C. Hambuechen state[17] that they work at 30° C. A. Pfaff gives 70° C. as the temperature at which he obtained the best results. It is certain that if it is desired to use high current densities the temperature must be at least as high as 60° to 70° C. The writer has used the following conditions with success:—**Temperature,** 70° to 80° C.; **Current density,** 100 amp./ft.^{2}; with this current density he has obtained deposits of sound and close-grained metal up to ⅛" thick and at the average rate of 4½ thousandths of an inch per hour; **Anodes,** Swedish iron.

(b) Observations on the Working Conditions.—The working limits of the sulphate bath are wide, except in regard to the important matter of free acid content. But the sulphate bath compares badly with the double chloride in these respects, namely (1), the rate of oxidation of the solution is much greater (in the absence of considerable free acid), and (2) the rate of evaporation is greater also. The latter defect is especially harmful, since it is frequently necessary to add water to the solution, and this causes both a temperature drop and, more important still, causes the sludge at the bottom of the vat to be stirred up. For work on a large scale an automatic water feed has to be arranged. As regards the employment of movement, the remarks made above in regard to the chloride bath apply to the sulphate solution also.

GENERAL RULES OF PRACTICE

It is to be noted that the amount of a substance which can be held in solution at any temperature is limited. In general, the higher the temperature, the more solid substance the solution can contain. It follows that a solution saturated at a higher temperature will deposit salts as the temperature cools. This is the case with hot iron baths, and is a source

*From Beama, Part 1, was published in our October issue.

[13] Ger. Pat. No. 309271 (1. 12. 17).

[14] On the subject of "complex ions," which the writer believes to play a considerable rôle in the reaction of depositing solutions, the reader will do well to consult R. A. Lehfeldt's Electro-chemistry, 1904, p. 133 (Longmans).

[15] On, that is, what may be called "double" sulphate baths. But *cf.* A. Russ and A. Bogomolny, Zeit. f. Elektroch., 1906, vol. 12, p. 697.

[16] Zeit. f. Elektroch. 1910, vol. 16, p. 217.

[17] Electrochem. Industry, 1904, vol. 2, p. 184; Trans. Am. Electrochem. Soc., 1904, vol. 5, p. 201.

of inconvenience and, sometimes, of trouble. In order to prevent as far as possible the precipitation of salts, it is well to adopt some such procedure as the following. When work ceases at the end of the day, the heat supply, instead of being shut off, should be reduced only, the solution level having first been made up (if necessary) with **hot** water. At week-ends and before holidays such procedure would be too costly. In the case of the chloride baths there will be no difficulty in breaking up and re-dissolving the cake of salts which separates; but in the case of sulphate baths there will be more difficulty, since sulphates of iron are much less soluble than chlorides. In this case there is nothing else to be done except to maintain a small heat supply over the week-end or holiday, or to use a less concentrated bath. This is a matter of cost and convenience, and has to be settled, in each case, in the light of working experience. A rule of practice which should be observed in the case of iron baths, and especially in the case of those that are maintained acid, is that the anodes should be removed from the solutions when work ceases; they should be well scoured and then dried. Another rule of practice, of general application, is one that should be observed very carefully in iron deposition. It is this—when once deposition has begun, the article receiving the deposit must not be removed from the solution, whether "to see how it is getting on" or for any other purpose. Every time that is done the continuity of the deposit is broken; every such discontinuity can be seen on the polished and etched surface of the deposit. It is marked by a line (as seen in Fig. 1), and it may easily become the locus of fracture. For a similar reason the current must not be cut off during the deposition. And again, if movement is employed, this must be continued throughout the whole period; any stoppage of the movement can be seen if a polished and etched surface be examined (Fig. 2). There will be a change in structure resulting from the change in conditions of deposition, namely, motion to no motion.

STRUCTURE OF IRON DEPOSITS

(a) Macroscopic. The appearance of a deposit should be light grey in color, and it should be smooth. There should be little or no outgrowth at edges and corners. It should be either matt or very minutely crystalline to the naked eye; if it is bright and metallic, without visible structure, the deposit will be hard, but brittle. If the color is dark and, apparently, no structure, too much current has been used; excessive current is also proved by a powdery deposit, especially on corners and edges. Where an acid solution is employed, the deposit will be bright and hard looking, but light gray, if too much acid is present in the bath. If no means of movement is adopted, the macroscopic aspect will be, under normal conditions, crystalline, and the higher the current density employed, the more coarsely crystalline the deposit will appear. If movement is used, then, if the deposit looks crystalline to the eye, one can be pretty sure that the metal content is tool low for the current density used; in this case, either more metal must be added or the current density lowered.

(b) Microscopic. As with all electro-deposits, so with deposited iron, microscopic features and microscopic structures are co-related. A matt or bright deposit will be fibrous within; it will look as though it consists of thin threads or fibres. Acid and movement, each of them, will give rise to such an internal structure. If the deposit is crystalline to look at, the internal structure will be more or less coarse. It will consist, not of threads or fibres, but of grains which grow wider from within (near the base metal, that is) outwards. The more coarsely crystalline the deposit appears to the eye to be, the larger the grains of which it consists will be seen to be if a polished and etched section be examined under the microscope.

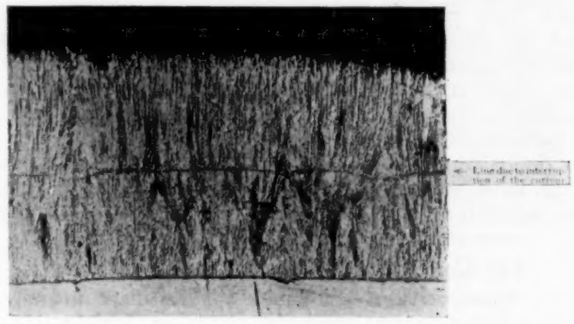

FIG. 1. DEPOSIT FORMED IN SULPHATE OF IRON SOLUTION CONTAINING CONSIDERABLE FREE ACID. THE FIBROUS STRUCTURE IS VERY MARKED.

It is very clear from the illustrations in this issue that a deposit that is fibrous throughout its thickness is more homogeneous in structure than any "normal" structure can be. Where homogeneity is required precautions must be taken to adopt the deposition conditions that will produce it. At the same time, it has to be remembered that a fibrous structure usually connotes brittleness, while a deposit that looks coarsely crystalline is nearly always more or less malleable. It has also to be observed that if a fibrous structure is being produced, and the conditions are changed during the deposition (if, for instance, movement is stopped, or where acid is used to effect the fibrous form of structure, the acidity becomes too diminished) there will be a change in the structure. Thus, a deposit that is fibrous to begin with may change to one of normal type. Fig. 2 shows this

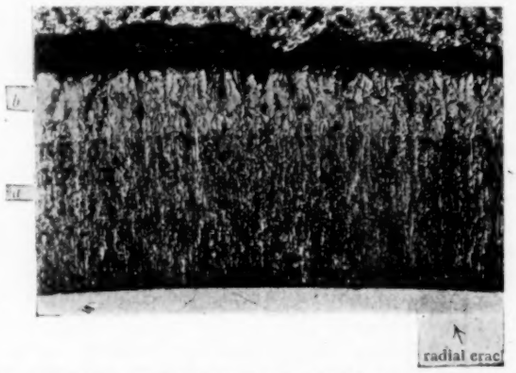

FIG. 2. DEPOSIT FORMED IN CHLORIDE OF IRON SOLUTION. THE CHANGE OF STRUCTURE FROM a (CATHODE MOVED) TO b (CATHODE STATIONARY) IS CLEARLY SHOWN.

change; it was due in this case to stoppage of movement. Figs. 3 and 4 illustrate the change—a very sudden one—from normal to fibrous, caused by the addition of an excess of acid to the bath.[18] Fig. 4, which is a micrograph of this deposit at higher magnification, shows that at the time the acid was intro-

[18] The writer has dealt more fully with the effect of acid in the structure of electro-deposited iron in a paper read at the ordinary meeting of the Faraday Society, April, 1921.

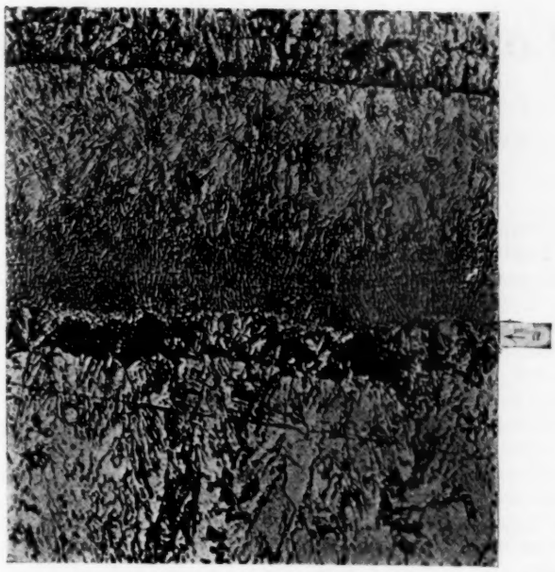

FIG. 3. THIS DEPOSIT SHOWS CHANGE OF STRUCTURE CAUSED BY INTRODUCTION OF ACID INTO A CENTRAL BATH. ALL OF THE STRUCTURE SUDDENLY BECOMES FIBROUS, DUE TO ADDITION OF ACID.

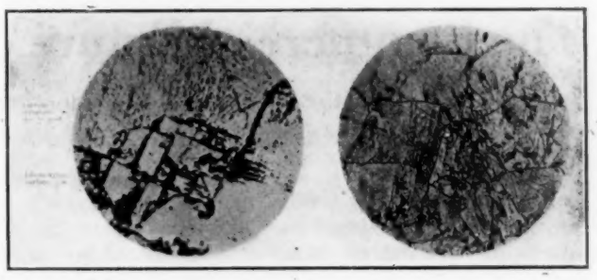

FIG. A. SAME DEPOSIT AS IN FIG. 3. NOTE CHANGED DEPOSITS.

FIG. 5. HYP-IDIORMOPHIC STRUCTURES OF THE DEPOSIT FORMED IN THE FERROUS CALCIUM CHLORIDE SOLUTION.

duced the surface of the deposit was covered with idiomorphic crystals of iron. Such a surface would have appeared to the naked eye very coarsely crystalline indeed—sparkling and brilliant from the light reflected from the facets of the crystals. The subscripts to Figs. 5 and 6 indicate sufficiently what they are intended to show. Fig. 6 is especially noteworthy.

A point that it is particularly wished to emphasize in connection with the illustrations of structure given is that by the study of structure the depositor comes to obtain a very much greater control over the deposition process. A correlation of conditions of deposition and structure helps one to know of what a deposit really consists and, hence, to some extent, what its physical properties are.

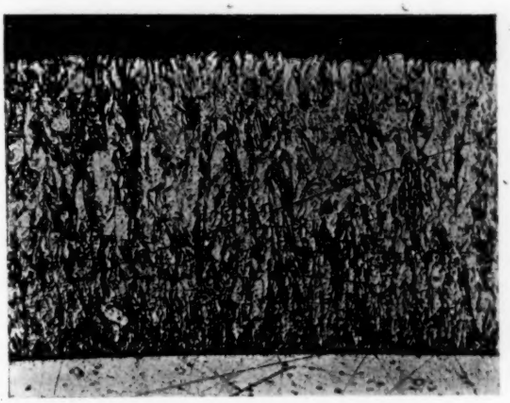

FIG. 6. THIS DEPOSIT HAS A BROKEN BUT STILL "NORMAL" STRUCTURE. IT WAS FORMED IN A SMALL QUANTITY OF SOLUTION (250 C. C. AND AT HIGH C. D. 120 AMP. FT.).

Lead Solutions

There are two types of lead solutions in use in the United States, the fluorsilicate and the fluorborate. The solutions may be used as still solutions, or mechanical of the rotating type. It is advisable even to agitate the still solution (either the cathode or the solution itself) o prevent occlusion of hydrogen in the deposit. We give you a formula for each type of solution. It is customary in the United States to purchase the lead fluosilicate solution from lead refiners. The solution is used as received without dilution with water.

Formula No. 1.

Water	1 gal.
Lead Fluosilicate ($Pb.SiF_6$)	10 to 14 ozs.
Free Fluosilicate Acid (H_2SiF_6)	2 to 12 ozs.
Transparent Glue	¼ to ½ oz.

Temperature normal at 2 volts and upwards. Amperage 10 to 25 per square foot of surface.

Formula No. 2.

Water	1 gal.
Hydrofluoric Acid, 40% (H_2SiF_6)	2 lbs.
Boracic Acid (H_3BO_3)	12 ozs.
Dry White Lead ($2PbCO_3.Pb(OH_2)$)	1 lb.
Transparent Glue	¼ to ½ oz.

Temperature normal at one to two volts. Ten to twenty-five amperes per square foot of surface. Rotating mechanical apparatus will require twice the voltage.

Formula No. 3.

Water	1 gal.
Sodium Hydroxide (NoOH)	1½ lbs.
Lead Acetate ($Pb(C_2H_3O_2)3H_2O$)	10 ozs.
Yellow Rosin	¼ oz.
Turpentine	

Formula No. 4.

Water	1 gal.
Rochelle Salts $KNaC_4H_4O_6.4H_2O$	5 ozs.
Lead Cyanide $Pb(CN)_2$	2 ozs.
Sodium Hydroxide NaOH.	1 oz.

Temperature 160° at 2 volts.

The alkaline type of solutions Nos. 3 and 4, are used principally for thin lead deposits, owing to their greater conductivity, or for basic deposits before plating in the regular acid solutions to prevent local action upon the iron or steel. However deposts of copper from copper cyanide solutions may be used for basic deposits.

C. H. PROCTOR.

The Commercial Future of Copper, Brass and Bronze

Read Before the Session of the American Mining Congress, Chicago, Ill., Oct. 19, 1921

By Capt. HARRY GEORGE, Research Dept., Chase Metal Works, Waterbury, Conn.

The corrosion of engineering materials and metals in particular has been the subject of laborious research for many years and much has been accomplished in this difficult field. Laboratory experimental work is apt to appear inconclusive and conflicting and does not always accord with actual experience. In actual installations the environment is more complex and cannot be so accurately controlled. Abnormalities due to unknown or obscure conditions constantly occur and often defy patient investigation. Corrosion is by all odds the most vital subject before the engineering world. It is the cause of the deterioration and ultimate destruction of all things made by man. Man wrests the metals from the earth, holds them for a brief time in unstable equilibrium, and nature with an inexorable hand restores stability by oxidation and returns them to the soil.

It is not my intention to cast the slightest discredit on intensive laboratory work, but to point out that the practical efficiency of any material for engineering purposes can be established only by prolonged service.

There is a fundamental economic loss to industry whenever an unsuitable metal is used in fabrication. This loss is not only the direct expense and labor involved in repeated replacements and repairs, but in the repeated waste of capital and labor, which if rightly used in the first instance could have been devoted to other channels of more benefit to society than the mere repetition of a needless task.

RESISTANCE TO CORROSION

Copper, brass and bronze have been held from time immemorial in high esteem wherever strength, easy working qualities and resistance to corrosion are essential. Within a comparatively few years the appearance of cheaper and inferior metals has resulted in their use through a false conception of economy based only on a lower first cost. Unfortunately there has been little effort on the part of copper and brass producers and manufacturers to withstand this invasion. This situation began before the World War and developed rapidly during hostilities on account of the scarcity of the non-ferrous metals and the absolute necessity of using other materials. Ingenious advertising and aggressive promotion have been weighty factors in this development. Claims have been made that many of the ferrous alloys are distinctly superior to the non-ferrous in endurance, notwithstanding the concensus of competent technical opinion to the contrary. There has been nothing adduced to substantiate these claims either in theory or practice and they rest not on the dictum of engineers but on clever advertising. Copper and brass have been in favor for a variety of purposes for so many years that a concerted effect to protect them from the inroads of newer and inferior substitutes has as yet scarcely been considered. In the construction of locomotives the relative weights of bearing metals, copper and brass pipes, locks, valves, etc., have been slightly reduced during the past twenty years. Specifications for most foreign locomotives require copper or brass for boiler tubes and stay bolts, and in many cases for fire boxes also. The English practice inclines to copper, while brass is largely used on Australian and South American lines. Copper tubes have been used even in flue heaters with economy and success. The use of copper tubes instead of steel insures not only a longer life but also that the locomotive spends less of its active career in the shop undergoing retubing and the stoppage of leaks. In these days of high fuel costs, high transportation rates, high wages and high general operating expenses every economy should be introduced in railway management by the employment of only the most efficient materials.

The life of a locomotive copper boiler tube is estimated at about three times that of steel. An English railway authority claims that a life of from 240,000 to 360,000 miles is obtained with copper tubes as against 80,000 to 120,000 miles for steel. In addition to this we have the higher heat conductivity of copper and a scrap recovery value of old tubing much higher relative to the original cost than the scrap value of steel. We are entering upon a new era of industry and the broad field of aggressive International competition. If we are to succeed it is imperative that the utmost economy be practiced from the humblest worker to the chief executive. We talk glibly of the supreme necessity of thrift in the individual—what America most needs is thrift in industry.

The metallurgical staff of one of the prominent manufacturers of copper bearing sheet steel (containing not more than 0.25% copper) debates in the transactions of the American Electro-Chemical Society with the Research Department of an open-hearth steel company as to which product is the more resistant to corrosion. As a matter of fact sheet copper under similar conditions is many times more resistant than either.

Mr. D. M. Buck, Metallurgical Engineer of the American Sheet & Tin Plate Co. in these transactions, states as follows: "By adding small amounts of copper (approximately 0.2%) to steel and iron the corrosion rate under conditions where the product is alternately wet and dry is tremendously reduced." A paper by Messrs. Aupperle and Strickland, Chemists of the American Rolling Mill Co., says: "Samples alike in analysis except for copper content made from the same heats indicate that the copper was responsible for the more rapid corrosion of the copper-bearing sample. The copper was the only varying factor in the two grades of metal." This substantiates figures from their own experiments showing the relative resistance of open hearth iron and steel to copper-bearing iron and steel as several times that of the latter. In an experiment which approximated actual atmosphere conditions as closely as practicable in a laboratory E. D. Richardson, in a paper read at the American Institute of Chemical Engineers, found over a period of 1,000 hours that a sample of copper bearing iron was completely disintegrated and that another showed a corrosion of about 292 times that of copper under like conditions. An iron approximating in analysis that referred to by Aupperle and Strickland showed 212 times the corrosion of copper.

I quote these conflicting opinions to show that laboratory results should be accepted with caution and that the adaptability of a metal to any specific purpose can be determined only by actual use. The layman might naturally inquire why not use a greater copper content and profit by the well-known resistance to corrosion of that metal, unaware of the fact that minor changes in composition often result in marked changes in physical characteristics and might place the metal or alloy outside the category of engineering materials, or he might ask why not use straight copper in the first instance and realize in full the known resistance to corrosion of that metal.

In the laboratory at the Chase Metal Works we have initiated a series of tests under varying conditions to de-

termine the actual loss by corrosion to many of the best known ferrous and non-ferrous metals and alloys. The first series covers their resistance to a 1% solution of hydrochloric acid at atmospheric temperatures and shows that copper, brass and bronze have a considerably greater resistance to corrosion under these test conditions than have any of the irons, steels, special irons and steels subjected to the same test. It is our intention to continue these experiments under various conditions of attack. The action of corrosion may be retarded by a change of constituents or by covering the metal with some protective coating. These protective coatings involve a high maintenance charge and often fail to accomplish the desired object. Immunity from corrosion without such coatings is one of the most desirable features of copper, brass and bronze. Over a period of years the initial higher cost of these metals is small as compared with the annual outlay for the upkeep and repair of cheaper substitutes. Copper roofing as compared with ingot iron or galvanized iron over a period of 30 years, a conservative estimate for the longevity of copper from authentic records is about 10 times that of galvanized iron and from 3 to 4 times that of ingot iron. Assuming that galvanized and ingot iron will require painting every second year it can be readily deduced that for the 30-year period, using our current market prices that the relative cost of copper, ingot iron and galvanized iron will be in the ratio of 1, 2 and 6, showing a marked saving for copper on account of its superior endurance and extremely low costs of maintenance. Thirty years is a conservative estimate for the longevity of copper roofing and has frequently been exceeded.

USE IN BUILDING TRADES

The building industry consumes large quantities of copper and brass. In this important industry less of these metals is used than before the war and the mania for cheap materials without regard to upkeep and repairs are contributory causes. The producers and fabricators of copper and brass have assumed a passive attitude in the face of a strong and aggressive competition. Public ignorance as to the merits of engineering materials is widespread and has never been corrected. Architects are in agreement concerning copper and brass and many of them instruct their clients as to what ultimate savings may be anticipated before specifying other materials. They are agreed that copper is the best of all materials for roofs and flashings and the same opinion is generally entertained by practical builders and sheet metal workers.

A prominent roofer states that copper is the best known material for all roofing purposes and has proved so over and over again, and that a roofer using copper knows that his work will endure and he is better off in reputation than if he had used a material which would disintegrate in a year or two. Cases where copper has failed have invariably been due to the faulty manufacture or to careless installation.

In the plumbing trade brass is largely used for piping and there is also a large consumption for fixtures either plain or nickel plated. In the more expensive buildings high-grade brass is specified especially for the hot water service, but in the low grade construction brass is frequently forced out by cheaper and less durable metals. The superiority of brass pipe is conceded by plumbers on account of the endurance and resistance to corrosion. There are innumerable instances on record where iron pipes after three or four years' service have been found so filled with rust that an ordinary lead pencil could not be passed through them. This rust action which seems inevitable in iron pipe will cause leaks not only in the joints where the thread has decreased the thickness of the metal, but at other points of structural weakness. Brass pipe has occasionally failed from "season cracking." This defect is due to initial strains in the metal, a condition now understood by manufacturers and can be eliminated by a suitable relief anneal. In concealed piping where costs of repairs are necessarily heavy on account of tearing out walls and floors iron pipe should never be installed. It is interesting to observe how little the cost of brass pipe for plumbing affects the total cost of the entire plumbing job. The labor charges and cost of fixtures are practically the same in either iron or brass piping. In a large residence in which brass was to have been used throughout it was found that the substitution of iron for brass would only reduce the price of the entire plumbing job by about 2%. A construction company states that it has a house that cost fifteen thousand dollars six years ago. The installation of all brass pipe would have increased the cost by only $200. The same house today would cost $30,000, but the additional cost of all brass piping would not exceed $300, due to the smaller increase in the price of brass over pre-war conditions.

I had the opportunity during the late war to compare the comparative endurance of brass pipe with ordinary commercial iron piping. We were called upon to immediately construct barracks for 5,000 men. On account of the scarcity of brass, iron pipe was used for wash rooms, bath rooms, laundries and other sanitary facilities. The iron piping gave no end of trouble and the leaks were a source of daily inconvenience and annoyance. The older barracks, built before the war and equipped with brass plumbing, gave no trouble. The situation was aggravated by our having to use brackish water for many purposes on account of the shortage of potable water, a situation not uncommon in the United States. I have recently examined a number of relics from the battlefields of France. Articles of copper, brass and bronze are invariably in a good state of preservation, while iron and steel are badly pitted and corroded. The contrast is particularly marked in a German cartridge case, of which the base is brass, but the cylindrical body has been pieced out with iron—sheet. The brass portions are in excellent condition, whereas the iron is so corroded as to be practically worthless.

USE IN SHIP BUILDING

In the ship building industry the World War led to the substitution of brass and copper and bronze by less suitable materials. The re-conditioning of ships at the conclusion of hostilities demonstrates the inferiority of such substitutes. It is the universal opinion of shipbuilders that copper and brass by their endurance and low cost of maintenance more than compensate for their higher first cost. Copper and brass sheathing is incomparably superior to other metals, and the superiority of copper for wood fastenings is proverbial. I have often been impressed by the excellent condition of sheathing, bolts, cleats and various deck fittings of copper and brass removed from old ships after years of wear and tear in an environment peculiarly conducive to corrosion. Naval bronze is used for so many purposes on board ship that it proached this alloy for strength and non-corrodibility. is impracticable to name them here, and nothing has ap- Copper piping is used as a rule on steam and exhaust lines, high pressure air lines, in the flooding and drainage systems and other purposes where longevity under adverse conditions is of prime importance. Brass piping is used throughout in the hot and cold water systems and in the sanitary plumbing, and for efficiency outdistances all competitors. On shipboard the general conditions are more conducive to corrosion than in other installations. We have salt water to deal with, besides waste oils, ashes and adverse climatic conditions, poor ventilation and many other causes of deterioration.

For condenser tubes brass stands pre-eminent. Muntz Metal has been used for years, but the Admiralty Mixture

is becoming general, particularly if the circulating water is contaminated, which is generally the case in our large seaports and centers of population. Exhaustive experiments by our Navy Department and by the Corrosion Committee of the British Institute of Metals show that no alloy that can be commercially drawn into tubing compares with this mixture. For stationary installations this alloy is becoming the standard and has supplanted Muntz Metal, especially where the conditions are most favorable to corrosion. For marine purposes materials must be strong, durable and highly resistant to corrosion. Copper, brass and bronze admirably fulfill these requirements.

The environment in mining is apt to be more unfavorable to endurance than on shipboard. The presence of acids and alkalies impregnated by metallic salts, poor ventilation and excessive moisture demand a careful study by the Engineer in his choice of materials. It is fair to assume that many of the materials for marine work would be found equally efficient in mining installations.

USE IN AUTOMOTIVE INDUSTRY AND GENERAL HARDWARE

Of late years various alloys have superseded brass in miscellaneous hardware. Hardware should be permanent and not subject to the frequent replacement and repairs. Nothing is more unsightly than the hardware we see every day, disfiguring paint work by excessive rust—doors hanging on the fragments of a hinge, padlocks closed by rust, staples gone and many other indications of waste. There is a strong tendency to plate iron and steel hardware with brass. I have no doubt that many consumers purchase these articles under the impression that they are getting solid brass and are disappointed at the unsightly appearance which obtains when the plating wears away and the bare iron or steel surfaces rapidly corrode. True economy would dictate solid brass in the first instance to insure a reasonable length of service and satisfaction to the consumer. In cooking utensils copper has been supplanted by other metals in the lighter implements, but for heavy service such as ships, galleys, hotel kitchens and the candy and food industries copper holds its own.

Before the war the automobile industry had always used a fair quantity of copper, brass and bronze. During hostilities on account of scarcity they were replaced by substitutes. Because of their cheapness the use of these substitutes has continued. Coincident with this substitution has been the enormous increase in the automobile repair business out of all proportion to the increase in the number of cars. The absence of copper products is particularly noticeable in the rapid deterioration of cars in cities where subjected to the corrosive nfluences of salt air, gases from industrial plants, the use of crude oils and various dust-laying compounds on roadways undoubtedly contribute to this result. The effort to keep prices down by the employment of cheap materials in structural and working parts is poor economy to the owner. It is reported that the American car which utilized in its construction the largest amount of copper and brass products had been acknowledged by European engineers as the best car in this country and during the war was the choice of one of the allied governments for high-grade duty.

Although the legitimate field of copper and brass has been encroached upon it is not due to the intrinsic superiority of other metals, but rather to the fact that copper and brass have been left to depend on their established merits whereas the newer competitors rely chiefly on a lower first cost. Brass, Copper and Bronze has as wide a field as ever before, and it is the object of this paper to arouse public attention to a condition, which if not rectified will result in a national economic loss. To combat the flooding of the market by cheap and unsuitable substitutes the copper and brass producers and fabricators should unite with the engineers in a campaign of public education to check this growing evil. It is not my intention to cast discredit on any particular metal. All have their spheres of usefulness, but it is the duty of the technician to insist that none are diverted to undertakings for which they are clearly unsuitable from the viewpoint of ultimate economy after a prolonged service.

The commercial future of copper, brass and bronze is assured. It is confidently asserted that both Engineers and Consumers will return to the policy of using only such materials that show by endurance a maximum return on the investment and will no longer be beguiled by the fetish of a lower first cost.

Prize Winners in Cleaning Essay Contest

The winners in the 1921 $500 Prize Story Contest on "To What Extent Does Cleaning Influence Production and Quality," held by the Oakley Chemical Company, New York, are as follows:

First Prize, $100—Mr. H. F. Penney, Geneva, New York.

Second Prize, $75.00—Mr. H. W. Roper, Milwaukee, Wisconsin.

Third Prize, $50.00—Mr. J. W. Horne, Canton, Ohio.

Fourth Prize, $25.00—Miss Margaret Wade, London, Canada.

The winners of the $10.00 prizes are: Mr. William H. Addis, Fort Worth, Texas; Mr. F. L. Balbach, Cleveland, Ohio; Mr. William Barnes, Montreal P. Q., Canada; Mr. Bruce A. Boggs, Lancaster, Pa.; Mr. Robert J. Bueter, Detroit, Mich.; Mr. William H. Butler, Boston, Mass.; Mr. George B. Daniels, Grand Rapids, Mich.; Mr. Frank Deffry, San Francisco, Cal.; Mr. J. J. Doan, Franklin, Indiana; Mr. Benjamin W. Gilchrist, Montclair, N. J.; Mr. James Graham, Pittsfield, Mass.; Mr. Raymond Heron, Connellsville, Pa.; Mr. J. E. Housley, East St. Louis, Mo.; Mr. E. S. Hughes, Detroit, Mich.; Mr. Ralph K. Hutchings, Rochester, N. Y.; Mr. Richard H. Marshall, Groton, N. Y.; Mr. Irving Mattick, St. Louis, Mo.; Mr. R. E. Sanborn, San Francisco, Cal.; Mr. C. L. Sonen, Indianapolis, Ind.; Mr. Edward H. Tingley, Dayton, Ohio; Mr. Bernard C. Wade, New Bedford, Mass.; Mr. D. W. Wait, Pittsburgh, Pa.; Mr. A. C. White, New York, N. Y.; Mr. Robert B. Whyte, Kenosha, Wis.; Mr. C. L. Witt, Seattle, Wash.

Imitation French Antique

An imitation of the French Antique Finish may be prepared as follows: Acid dip the medal. Then immerse in a hot solution of barium sulphide, caustic soda and ammonia.

Water	1 gal.
Barium Sulphide	1 oz.
Caustic Soda	4 ozs.
Ammonia Water	1½ "

The medal will turn a reddish brown. Remove and wash and relieve the brown tone from the high lights with bicarbonate of soda or very fine pumice stone. Then rewash in water, dry out and sand blast very lightly, as previously outlined for French Bronzing. Now wax down the medal using either the plain wax composition or mixed with a little fine French bronze powder as the finishing medium. Finally brush down with the soft waxing brush.—C. H. PROCTOR.

THE METAL INDUSTRY

With Which Are Incorporated

THE ALUMINUM WORLD, COPPER and BRASS, THE BRASS FOUNDER and FINISHER, THE ELECTRO-PLATERS' REVIEW

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EDITORIAL

UNEMPLOYMENT RELIEF

A very creditable result of the interest shown by the Government in helping to revive industry and to ameliorate the difficulties of the present situation, is the set of conclusions and recommendations of the President's Conference on Non-Employment, conducted by Herbert Hoover, as Chairman, and his associates. It was shown that in the first place a great deal of misleading information had been circulated as to the number of unemployed, and that consequently schemes for improvement could not be undertaken until authoritative data had been obtained. The Conference found that the number of unemployed was estimated at from 3,500,000 to 5,500,000, with a much greater number dependent upon them. There has been some improvement recently but not enough to state that the difficulty is passing with any degree of rapidity.

The Conference recommended as follows:

1. Private houses, hotels and offices, etc., should make repairs, alterations and cleanings, etc., during the winter instead of waiting for the spring.
2. As much public construction as possible should be undertaken, rather than relief measures. A large quantity of municipal and state bonds have been sold under very favorable conditions, due to the fact that they are tax exempt, and the funds obtained should be employed as soon as possible. Municipalities should give short time employment as well as other employers.
3. Building construction should be encouraged and aided to the utmost, not only to aid the unemployed, but to overcome the acute shortage of houses.
4. Manufacturers should make every effort to relieve the present situation by part time work, rotation of jobs, manufacturing for stock as far as possible, plant repair and reconstruction, reduction of the number of hours of labor per day and of the number of days per week per person.

It is stated that the problem is to a great extent a local one and that a large part of the aid should come through municipalities working under state examinations.

Measures recommended for permanent recovery are as follows:

1. Readjustment of railway rates.
2. Completion of the tax bill to relieve the present uncertainties of business.
3. Settlement of tariff legislation.
4. Settlement of the financial relationship between the Government and the railways.
5. Limitation of world armament to increase tranquility and to decrease tax burdens.
6. Steps to be taken to minimize the fluctuations in exchange in order to improve our foreign trade.
7. Definite programs of action to eliminate the wastes in industries exposed by the recent reports of the Committee on the Elimination of Waste in Industry.

It is emphasized that the chief of all factors to hasten readjustment, is an earnest purpose throughout the whole Nation to take only what is fair and to assist others to win what they are justly entitled to have.

Excellent as these measures are they are useless without being followed up by an energetic campaign of application. The success of this combination depends upon the ability and earnestness of the local committees in charge, and the amount of co-operation which they receive from their communities, not only to increase employment, but to cut down unnecessary drains on the consumer whether he happens to be employed or not. One commendable attempt along this line is being made by the National Association of Purchasing Agents to help lower costs of living by reducing the cost of distribution. As stated by W. L. Chandler, President of this Association, one of the ways in which they will attempt to help is to discourage a growing tendency of individuals to seek a living from commerce without rendering adequate return in the form of service to the community. In other words, they intend to eliminate the speculator and the middle man and jobber where he is unnecessary. No more creditable step could be taken.

BRITISH INSTITUTE OF METALS

The Fall meeting of the Institute of Metals held in Birmingham, England, was fully up to its regular standard. The program was rich in important papers, among which were Nickel-Aluminum-Copper Alloys, The Effect of Lead in Gun Metal, The Casting of Brass Ingots, The Working and Annealing of Copper, Extrusion, Aluminum Alloys and Age Hardening, Electrolytic Etching, and Electron Metal.

It was interesting to note that according to Rolfe, lead in gun metal can safely be omitted up to one per cent, except where high temperatures exist, such as those of super-heat.

In the paper on Casting of Brass Ingots, by Genders, it was brought out that a large proportion of failures of hollow drawn articles are caused by non-metallic inclusions. This is, of course, directly traceable to faulty pouring of the ingots. It is recommended that a hot sink lead or "dozzle" be used. As Dr. Rosenhain pointed out, this is simply using steel and iron foundry practice for brass, and should, undoubtedly, work well. Extrusion difficulties were discussed at great length. Abstracts of the papers and the discussion which followed are printed elsewhere in this issue.

Sir George Goodwin, the president of the Institute, gave an address in which he emphasized the need of the navy for lighter metal construction without the sacrifice of strength. This need, is, of course, fully as great in the airplane and in the automotive industries. He pointed out that the problem could only be solved by co-operation between the metallurgist, engineer and the manufacturer. The reason for the large surplus weight now considered necessary is the item of factor of safety which is included because metal parts are known to be lacking in uniformity, and the design must be such that there will be sufficient strength at even the weakest point. If metals could be so manufactured and fabricated that they were uniform throughout, a large part of this factor of safety could be eliminated, thus cutting down the surplus weight which is only an added load of no real use.

It was in every sense a successful meeting. The members were well entertained by Birmingham and greatly stimulated by the papers read.

AMERICAN ELECTROCHEMICAL SOCIETY

The Fall meeting at Lake Placid, N. Y., was a happy combination of an unusually interesting technical program and an enjoyable holiday. Between technical ses-

sions, the visitors spent their time in golf, tennis, motoring and mountain-climbing.

Two symposia of unusual interest to the metal industries were held. One, on non-ferrous metallurgy, included a number of papers on electric melting. Alloys of the common metals and the alkaline earth metals were discussed at considerable length. The other symposium covered electrodeposition in which papers on the deposition of iron, copper, zinc and tin-lead alloys were read. A report of this meeting with abstracts of the papers is published elsewhere in this issue.

Mr. Patch gave some very interesting results of his experience with electric furnaces as compared with fuel-fired furnaces. His report was particularly valuable since it came from a furnace operator with absolutely no bias. He stated substantially that in his experience the cost of melting the alloys, and the solution of gases in metal are approximately the same in both types of furnaces, provided intelligent operation is pursued throughout. There was, of course, the very important factor that working conditions are considerably better under the conditions obtained in electric furnace shops. Mr. Patch's conclusions will have weight with other foundry operators.

Mr. Anderson read a comprehensive paper on Aluminum-Copper Alloys, discussing manufacture, properties and use of this mixture as employed in the United States.

Messrs. Blum and Haring found that a finer grained deposit of alloys of lead and tin could be obtained from fluoborate solutions than when depositing either of the metals under similar conditions. Mr. Blum also found that a much greater tensile strength resulted if alternate layers of copper and nickel were deposited, instead of heavy deposits of copper alone.

Meetings of this sort are certain to have a great effect on the metal industries. The American Electrochemical Society is to be congratulated on the high order of the papers presented, and the excellent preparations and management of the entire meeting.

"BRASS"

In the midst of a busy day our attention was arrested by an advertisement of a new novel with a highly auspicious title—"Brass," by Charles G. Norris. At once we thought, in our innocence, "Here is a good book. At least it has a good title," for we have a soft spot for Brass, which extends even to the dingy antique shops. So we bought the book and read it, thinking that for once Brass, a Cinderella among alloys, would come into its own before the public and get a share of the attention it deserves.

Once before we complained about the popular attitude toward Brass. To the lay mind, it brings up such associations as cheap watch cases, imitation gold bricks and counterfeit coins. Imagine the shock, therefore, when on reading this novel we discovered that the author had gone them all several better by connecting Brass with unhappy marriages!

We read the book through with an effort, in order to be able to judge it fairly—and perhaps also to judge Brass fairly. We learned that marriage is likely to be a success only on the farm, where both parties interested work hard all day and half the night. In the city its chances are slim. The "hero" tried it when he was poor and fell down; then he tried again when he was rich and fell down again, to say nothing of an attempt between the two, in which he did not even succeed in getting married. Also the hero's sister, his mother-in-law, his brother-in-law and others (including a lady whose relation to him was not of the sort to mention in a respectable metal journal) had their troubles. All in all, it was simply terrible.

Somehow or other we found it unconvincing. We were not in the least persuaded to remove ourselves to an apricot ranch. However, we make no pretensions to literary discernment. We say, after the fashion of the several great men to whom the remark has been credited, "For those who like that sort of thing, that is the sort of thing they like." We were not greatly perturbed by the fates of the various characters, believing that in the first place they were not really alive, and in the second place, what happened to them (or anyone else) was of their own making. Nevertheless, one thing does arouse us to righteous wrath. Disclaiming all intent to preach to the world on Religion, Politics, Marriage, Divorce or second-rate Fiction, we wish, very hard, that the public in general and the writers of the above-mentioned second-rate fiction in particular, would leave Brass alone! Without it they would be horribly uncomfortable. Brass is a humble, willing, honored and faithful servant—and see what reward its virtue receives! We wish some novelist (a really good one) would write about someone poor and downtrodden and useful who rose by virtue of his basic worth (or her's—we don't mind if the hero is a heroine), and then point to him (or her) with pride, saying, "He (or she) has a heart of purest —Brass!"

NEW BOOKS

Examination of Iron and Steel and Brass, by Hall and Williams. Published by McGraw-Hill Book Company, 239 W. 39th street, New York. Size 5½ x 8, 501 pages. Price $5, payable in advance. For sale by THE METAL INDUSTRY.

This is the first edtion of a volume which makes it its business to specialize in just one thing, namely, the laboratory examination of metals. Part 1 takes up the chemical analysis, in which chapter 12 is devoted to the analyses of non-ferrous alloys. Most of these analyses are well tested methods taken from recommendations of the Bureau of Standards or from the American Society for Testing Materials. There is no question about the soundness of the methods recommended.

Part 2 is devoted to metallography, taking in the preparation of the specimen, the apparatus necessary and the photographic work. In this part is a chapter on the alloys of copper, giving very simply and in concise form without undue deviation, the elements of brass and bronze metallography and the methods of examining the alloys of copper.

The book is very useful, either for the student who wishes to get a fundamental idea of methods of examination or for the chemist who wants a practical, trustworthy and concise reference book.

Book of A. S. T. M. Standards. Published by the American Society for Testing Materials, Philadelphia, Pa. Size 6 x 9, 890 pages. Price, payable in advance, $10 with cloth binding and $11.50 in half leather binding. For sale by THE METAL INDUSTRY.

This is the 1921 edition of regular book of standards issued triennially. The A. S. T. M. is now, and has been for some time recognized as one of the foremost authorities on standardization of materials. The standards are recognized as authoritative for engineering materials and no manufacturer should be without copies of those materials which come within his industry. Sections of interest to metal manufacturers and metallurgists are included in the chapter on non-ferrous metals. This chapter contains 31 standards of materials and methods of analysis. Other sections give standards of numerous materials which come under the head of raw materials of the metal industries. These are, of course, very valuable for use by purchasing agents.

CORRESPONDENCE AND DISCUSSION

Although we cordially invite criticisms and expressions of opinion in these columns, THE METAL INDUSTRY assumes no responsibility for statements made therein.

HIGH LEAD BRONZE

To the Editor of THE METAL INDUSTRY:

We are pleased to note your article in the September issue under "HIGH LEAD BRONZE," "A Problem in Making an Alloy to Meet Exacting Requirements," "Answered by the ASSOCIATE EDITORS of THE METAL INDUSTRY."

This article and the apparent GENERAL CALL for relief in this particular anti-frictional line of metals, occasions this reply and unreserved offer on the part of this company to bring your inquirers relief in this field of apparently very general handicap.

In order to give you the clearer demonstration of our understanding of the matter and that you may publish this offer with the greater ASSURANCE for the general relief, we are sending you today by REGISTERED PARCEL POST a sample of HIGH LEAD BRONZE,—Formula 65 Copper, 25 Lead, 5 Tin, 4 No. 9 BORONIC COPPER "L" and 1 No. 6 BORONIC PHOSPHOR COPPER.

Tests on this particular casting show a tensile of 24,100 pounds per square inch and an elongation of 9.8. The test bar showing the figures just given, came from the riser of a casting made in the foundry of one of our customers, the riser having been sent us and being re-melted and cast in sand into a bar 6 inches long and 1 inch square.

As this Company specializes in HIGH-IN-LEAD, ANTI-FRICTIONAL ALLOYING PRODUCTS, it will naturally be a pleasure for us to assist your inquirers with our BEST SERVICE, WITHOUT CHARGE, other than through our alloying numbers, which, being all-metal, afford the user advantages over the usual run of fluxes and deoxidizers.

AMERICAN BORON PRODUCTS COMPANY, INC.

Reading, Pa., Sept. 21, 1921.

GOVERNMENT PUBLICATIONS

Relation of Lead Poisoning in Utah to Mining.—By Arthur L. Murray. Serial No. 2274. U. S. Bureau of Mines, Washington, D. C.

Salt, Bromine and Calcium Chloride in 1920.—By Ralph W. Stone, U. S. Geological Survey, Washington, D. C.

Phosphate Rock in 1920.—By Ralph W. Stone, U. S. Geological Survey, Washington, D. C.

Bauxite and Aluminum in 1920.—By James M. Hill, U. S. Geological Survey, Washington, D. C.

Fuller's Earth in 1920.—By Jefferson Middleton, U. S. Geological Survey, Washington, D. C.

Sand-Lime Brick in 1920.—By Jefferson Middleton. U. S. Geological Survey, Washington, D. C.

Silica in 1919.—By L. M. Beach, U. S. Geological Survey, Washington, D. C.

Mineral Resources of the United States in 1918.—Introduction by Edson S. Bastin, Summary by Martha B. Clark, U. S. Geological Survey, Washington, D. C.

Chromite in 1920.—By Edward Sampson, U. S. Geological Survey, Washington, D. C.

Smelter Production of Zinc.—Production, stocks and consumption, January 1 to June 30, 1920. Compiled by C. E. Siebenthal and A. Stoll, U. S. Geological Survey, Washington, D. C.

Copper in 1919.—By H. A. Jenison, U. S. Geological Survey, Washington, D. C.

Platinum and Allied Metals in 1920.—By James M. Hill, U. S. Geological Survey, Washington, D. C.

Arsenic, Bismuth, Selenium and Tellurium in 1920.—By Victor C. Heikes, U. S. Geological Survey, Washington, D. C.

Fluorspar and Cryolite in 1920.—By Hubert W. Davis, U. S. Geological Survey, Washington, D. C.

Strontium in 1920.—By George W. Stose, U. S. Geological Survey, Washington, D. C.

Graphite in 1920.—By L. M. Beach, U. S. Geological Survey, Washington, D. C.

Fuel Briquets in 1920.—By W. F. McKenney, U. S. Geological Survey, Washington, D. C.

Lead in 1920.—By C. E. Siebenthal and A. Stoll, U. S. Geological Survey, Washington, D. C.

Lead in 1919.—By C. E. Siebenthal and A. Stoll, U. S. Geological Survey, Washington, D. C.

Revised Manual for the Oil and Gas Industry Under the Revenue Act of 1918.—Published by the Internal Revenue Bureau of the Treasury Department.

Zinc in 1919.—By C. E. Siebenthal and A. Stoll, U. S. Geological Survey, Washington, D. C.

TECHNICAL PUBLICATIONS

Cracks in Aluminum-alloy Castings.—A paper to be presented at the meeting of the A. I. M. E. in February, 1922 in New York, by Robert J. Anderson.

The most important factors which cause cracks are: 1. Contraction in volume. 2. Composition of alloy. 3. Quality of melting charge. 4. Design of casting. 5. Method of molding. 6. Hardness of ramming. 7. Method of gating. 8. Hardness and characteristics of cores. 9. Chills. 10. Risers 11. Melting temperatures. 12. Furnace used for melting. 13. Pouring temperatures. 14. Inclusions in alloys. 15. Hot shortness of alloys. 16. Physical properties of alloys at high temperatures.

Methods recommended for prevention of cracks are as follows: Castings should be designed correctly, from both the foundry and the engineering standpoints; too hard ramming should be avoided, and the required hardness of molds may be determined experimentally where experience is an insufficient guide. The gates should be of ample size and attached correctly to the casting; the use of horn gates, where possible, is recommended for they permit the metal to enter the mold with the least disturbance.

Much of the difficulty experienced with cracking is traceable to the cores and to faulty core-room practice. The melting temperatures should be low; overheating in the furnace should be avoided. Open-flame furnaces should be run with a non-oxidizing atmosphere in order to avoid the formation of much aluminum oxide, and consequently occluded dross in the alloy. Skimming should be adequately and carefully done and the melting practice should be conducted as cleanly as possible. Foundry-floor sweepings should not be charged into the furnaces unless sieved, and foreign materials should be kept out of the furnace charges. The pouring temperatures should be as low as is consistent with filling the mold readily with metal; high pouring temperatures should be avoided. This presupposes pyrometric control.

Determination of Metallic Aluminum and of Aluminum Oxide in Commercial Metal, by Julian H. Capps, Bureau of Mines, Pittsburgh, Pa. From the Journal of Industrial and Engineering Chemistry, Vol. 13, No. 9, page 808, September, 1921.

The author describes a new method for determining and differentiating metallic aluminum and oxide in the metallic material by measuring the hydrogen evolved from reaction between it and a reagent.

By the method herein set forth these values can be determined rapidly and easily. There has long been a really great need of such a method, because aluminum is now bought on specifications based on a "difference" method of analysis, which utterly fails to consider oxide, nitride, carbide, and possibly other impurities which are undoubtedly almost always present. The ordinary analysis calls for determination of copper, iron and silicon, and the difference is said to be aluminum. As a matter of fact, this ordinary incomplete analysis is inadequate, giving only a superficial idea of metal quality. The present method supplies a longfelt need.

SHOP PROBLEMS

IN THIS DEPARTMENT WE ANSWER QUESTIONS RELATING TO SHOP PRACTICE

ASSOCIATE EDITORS { JESSE L. JONES, Metallurgical; WILLIAM J. REARDON, Foundry; PETER W. BLAIR, Mechanical; LOUIS J. KROM, Rolling Mill; CHARLES H. PROCTOR, Plating-Chemical; R. E. SEARCH, Exchange-Research

BRONZE TRUNION BUSHINGS

A.—At the present time we have to make some bronze trunion bushings, to be used on a Bascule Bridge, which weigh approximately 400 to 500 pounds each, and have to stand the following physical test:

Elastic limit in compression between 19,000 and 24,000 pounds per square inch.

Permanent set for 100,000 pounds load between 0.12 and 0.16 inches.

Bearings to be a copper tin alloy with a maximum content of 1 per cent Phosphorous.

We have made several test pieces, but the Permanent Set on 100,000 pounds is about .33 instead of .16. The analysis we used was as follows:

Copper	80
Tin	9
Lead	8
Phosphorous	7 to 1

Can you advise what mixture we can use, so as to obtain the above physical properties. These are for Government work, and are inspected by an Inspection Company.

A.—The mixture you give is generally used only for ordinary machinery bearings. Where castings are intended for use in contact with machine steel at low speeds and at pressures of about 1,500 pounds per square inch, as in the case of trunions and journals of bascule and lift bridges, the alloy used is copper 76¼, 15% phosphor copper 6¾, tin 17. This alloy has a deformation limit of at least 18,000 pounds per square inch when compressed. The deformation limit is the load that produces a permanent set of 0.001 inch in a compression test specimen which is made in the form of a cylinder one inch high and one square inch in cross-section area. The permanent set in one inch under 100,000 pounds per square inch is 0.10 to 0.20.

In making the above alloy the copper should be brought to a rather high heat, the posphor copper added a little at a time with thorough stirring and the tin added in a similar manner. The metal should be poured into ingots and remelted for use in the castings. New metal should be used and no scrap added except gates, risers, etc., of the same mixture. The metal should be carefully melted, kept well covered with charcoal, poured at a fair temperature and everything possible done to obtain solid, close-grained castings.—J. L. J. Problem 3,004.

CYANIDE COPPER

Q.—Please tell me through your paper what is the trouble with my cyanide copper solution. I plate mostly spun brass shells and run them about 30 minutes, but do not seem to get a very heavy plate. The solution stands about 18. The deposit peels occasionally and the solution will not plate over soldered parts.

A.—The density of a solution when in use for some length of time denotes nothing. Any substance soluble in water will raise the density to such water, so your statement that the copper solution stands 18 degrees Baumé can tell nothing as to the trouble with the solution.

Try reducing it one-third with clean cold water. Add one ounce of bisulphite of soda and 1 ounce of sodium cyanide per gallon. The latter may be increased to 1½ to 2 ounces to increase the rate of deposit.

If these additions improve the deposit and overcome peeling, then no further additions are necessary, except the usual upkeep of the solution.

If the deposit is still too slow, then make an addition of 1 to 2 ounces of copper cyanide and an equal amount of sodium cyanide per gallon. Dissolve the cyanide in as little hot water as possible, then add the copper cyanide. Mix thoroughly and add to the solution. The idea is not to use any greater volume of materials than your solution can take care of.

The one-third of the solution, which was removed, may be readded to the copper solution at intervals in small proportions. However, add about one to two ounces of sodium cyanide per gallon previous to adding it to the copper solution.—C. H. P. Problem 3,005.

MIXING ANTIMONIAL LEAD

Q.—We have been manufacturing antimonial lead by mixing antimony and lead in an open kettle, and have been experiencing trouble in casting the product.

In some cases, the metal will not make full castings, and in others, the castings are filled with small holes and sometimes show the white color of antimony at the top of the casting.

We, therefore, ask you to kindly write us any information that you may have on the subject or possibly suggest a different method of mixing. We feel confident that it is there that our trouble lies, since the metals which we are using have been tested and have been found to contain practically no impurities.—J. L. J.

A.—During the war period manufacturers, who were making shrapnel bullets from lead and antimony, had considerable difficulty in obtaining a uniform product, owing to the tendency of the two metals to separate. One firm that was working on rather a large scale, solved the problem by using a mechanical stirrer. The stirrer was shaped like a propeller and the pitch of the blades was such that the lead was lifted from the bottom of the kettle and passed upward continuously. The alloy was tapped from the bottom of the melting kettle into suitable molds for extruding into the wire from which the shrapnel bullets were formed. The alloy used was composed of lead 87, antimony 13, and analysis of the product showed that it was uniform and met the very exacting government specifications.

Antimonial lead of the above composition has a melting point of about 485 degrees Fahr., and for this reason ought to make full castings, free from blowholes, provided it is well mixed. The fact that some of the castings made from your antimonial lead showed the white color of antimony at the top of the casting, is proof that it was not properly alloyed.

A method of mixing that will prove satisfactory is to use a 3,000 pound capacity iron kettle, preferably heated with gas. Place the pigs of lead around the outside of the kettle and the antimony in the center. The slabs of antimony should be broken into quarters. Melt with a slow fire and leave in over night. Stir well before pouring into ingots.

Another method is to melt the lead, superheat it, and then add the antimony which has been melted in a crucible in a pit furnace and brought to a high heat.

In order to test the alloy it can be analyzed or tested by means of casting bullets and weighing on the Richard's balance. This balance gives the percentages of lead and tin in a solder, on one side of the scale and is graduated for lead and antimony on the other side.—J. L. J. Problem 3,006.

NICKEL ANODES IN GOLD SOLUTION

Q.—In the April issue of THE METAL INDUSTRY you suggest to use "Rolled sheet nickel anodes of about 16 Brown and Sharpe gauge in thickness in connection with gold and silver anodes in the baths of these metals."

We would like to try this and ask if you would be kind enough to let us know what proportion we should use, either for gold tank of five gallon capacity or a silver tank forty gallons capacity. Also tell us what length of time you would advise to use the anodes in connection with the others, and let us know where we could buy them.

A.—Rolled sheet nickel does not reduce very readily in cyanide solutions, so there is little danger of using an excess of nickel anode surface. For gold solutions, use one part nickel anode surface to three of gold anode surface.

In silver plating you could use 75 parts silver anode surface to 25 parts nickel anode surface. The nickel anodes can remain constantly in the silver solution as not over 5 per cent. nickel will deposit under the most favorable conditions.

As nickel becomes deposited with gold the gold deposit takes on a lighter and brighter finish.

As soon as the gold deposit shows too light a color remove the nickel anodes for a time, until the color becomes normal.—C. H. P. Problem 3,007.

PLUMBERS' SUPPLY MIXTURE

Q.—I am making a mixture of 65 copper, 33 spelter and 2 lead, and this mixture does not run very well. I am making plumbers' supplies and would like to know what I could use to improve the running of this metal. I would like to know if there is any flux that will improve the metal.

A.—The reason why this mixture causes so much trouble is the fact that the zinc content is too high for a good sand casting metal. The remedy is to add aluminum. Unfortunately aluminum is not safe to use on any work subject to hydraulic pressure. If not added properly it will cause the casting to leak. I question if there is any economy in using such a mixture for plumbers' supply work.

A good casting mixture for general plumbers' supply work is copper 75, zinc 21, lead 2, tin 2, and a cheaper mixture that will give good results is copper 69, zinc 28, lead 2, tin 1.

These mixtures can be cast successfully. The copper should be melted under a cover of charcoal together with a small amount of salt; the zinc should be broken into small pieces and placed around the furnace to heat when the copper is melted. Add the zinc, a small piece at a time, and stir well. Follow up with the lead and tin; pour the metal strong into the mold, keeping the sprue well filled, and use the sand on the dry side for molding.—W. J. R. Problem 3,008.

POLISHING ALUMINUM

Kindly forward me particulars in answer to the following on the polishing, buffing and coloring of aluminum utensils (sheet metal).

EMERY OPERATION.

What are the proper wheels to use? Grade of emery, also what speed. Could this operation be performed by allowing the work to spin slowly on a hand chuck or block.

BUFFING OPERATION.

By operating with an unstitched buff, what is the proper way to pad such buffs for an automatic buffing machine, also at what speed? Would a hard stitched buff answer the purpose and at what speed?

COLORING.

What is the proper buff or wheel for this work, also at what speed?

A.—Utensils made of sheet aluminum should not require emery wheel polishing.

We would suggest the following operations:

1st. Operation. If the sheet aluminum is rough, brush down with a tampico wheel; run at 1,500 to 1,800 revolutions per minute. For the cutting material 150 emery paste should be used. This material is put up in round cakes.

2nd. Cut down with stitched buffs 12 to 14 inches in diameter not less than 3 inches face, run at a speed of 2,200 revolutions per minute. Use a little kerosene oil applied to the buff to prevent the aluminum from glazing. Tripoli should be used as the cutting medium. Unstitched buffs may be used in the place of stitched. Just use enough sections to give you the desired face surface. Flanges not less than four inches in diameter should be used to support the unstitched buffs on the buff wheel shank. Flanges are usually made of gray iron turned up smooth to size.

3rd. Coloring is best accomplished by unsewed buffs. They are softer, especially if between each 12-inch section a small cloth disc, about 6 inches in diameter is used.

The small section gives more spread to the 12-inch buff, and it will color better. Speed from 2,200 to 2,500 revolutions per minute. If smaller buffs than 12 inches are used the speed should be increased to 3,000 per minute.

As the polishing medium use any of the good white lime compositions. Use a little kerosene. As previously outlined a better and cleaner finish will result.

You can use chucks to spin the work against the buff wheels. The chucks should be so constructed that they will revolve while the handle of the chuck is held firm, in other words a two-piece chuck.—C. H. P. Problem 3,009.

POLISHING CUTLERY

Q.—We have a problem of grinding a bevel on a utility or flexible butcher knife running from 12" down to a smaller knife 3 or 4" length—thickness .032 to .035—width from 1 to 1¾".

After grinding it will be necessary to polish. We want a high polish and would like to have your recommendations. We have a large quantity of knives held up for the grinding and polishing wheel. Our grinding machine has a shaft 1½". We can take a 16" wheel from 1½" to 2" face.

A.—Use compressed wheels or leather, canvas or linen ones, having steel centers. This style of wheel is used for polishing knives and cutlery.

Sea-horse wheels are used when a high-grade polish is required, but they are expensive and are used largely for polishing guns, pistols and high-grade cutlery.—P. W. B. Problem 3,010.

RUST-PROOFING MALLEABLE CASTINGS

Q.—We have for some time tried to secure a finish on a malleable casting which would be absolutely rust-proof.

We are at the present time using a formula which requires two operations, first, the zincing, and then a japanning operation.

Could you advise us as to whether there is some solution of a brown or a black color which is absolutely rust-proof, and which can be applied to a malleable casting and stand up under the strain which is placed on it in the harness?

A.—We are of the opinion that the method you now use in finishing your malleable iron buckles used in harness cannot be improved upon.

Zinc properly deposited gives the most satisfactory rust-proof deposit for iron or steel, a baked black enamel finish, the most satisfactorily wearing black finish.

The only other method you could use that would give a satisfactory basic rust-proof finish is the Bower-Barff finish, developed 50 years ago. The method consists of heating the parts to be treated in a closed retort to 1,250 deg. Fahr. for several hours. During the heating period steam is injected into the retort in connection with a hydro-carbon, such as benzine. The result on cooling of the iron parts is a black magnetic oxide of iron, which would be a satisfactory base for enamels.—C. H. P. Problem 3,011.

STEEL INSERTS IN BRASS

Q.—We are enclosing in the attached packet a sample of an article of our manufacture. At present we are annealing a steel insert and placing same in mold before casting the brass. We find at times that this method is not satisfactory. Could you offer some suggestions of any other method whereby we could cast this insert in a brass casting which must be absolutely tight and would stand quite a severe test.

A.—The best method that I know of for casting steel inserts in brass and one that would give a very tight job, would be to tin the steel inserts with pure tin. Pickle the black oxide from the surface with muriatic acid, using two parts acid and one part water. Then dip in a flux of chloride of zinc, then directly into the molten tin. Shake well to remove all the surplus tin. By tinning the steel insert, the brass adheres to the tin and makes a very firm joint, also stops blowing if not left in the mold too long. If any objection is made to tinning the whole steel insert, the part that is covered by the brass can be tinned by dipping each piece separately.

The steel inserts are evidently for automobile door handles. The instructions in this letter should overcome the difficulty mentioned. I would suggest a mixture of brass to be used as follows:

58½ copper, 41 zinc, ½ aluminum.

Melt the copper; get it good and hot, add the zinc a little at a time, and stir well. Add the aluminum, stir well, and pour. Do not let any lead get into the metal. This makes a nice metal to cast and is strong and has high shrinkage. Care must be taken in gating.—W. J. R. Problem 3,012.

PATENTS

A REVIEW OF CURRENT PATENTS OF INTEREST

1,385,223. July 19, 1921. **Alloy.** Foster Milliken, of Lawrence, N. Y., assignor to Foster Milliken, S. Fullerton Weaver and James M. Repplier, as trustees.

The invention relates to alloys containing aluminum and lead as the principal ingredients; and its object is to provide a new and improved alloy of this type characterized by pronounced density and ability to withstand pressure.

1,385,072. July 19, 1921. **Metal Alloy and Process of Producing the Same.** James B. Grenagle, of Cantonsville, Md., assignor to the Rare Metals Reduction Company, of Baltimore, Md.

This invention is a new metal alloy having many valuable properties particularly adapted for use in laboratory apparatus and electrolytic cells and for use in the chemical electrical and electro-chemical arts where platinum is now commonly used.

1,389,511. August 30th, 1921. **Process of Treating Lead Alloys.** James O. Johnstone, of East Chicago, Ind.

The present invention relates to an economical method of treating lead bullion, that is to say, lead containing some quantities of other materials, such as silver, antimony, copper, bismuth and the like, with the production of pure lead compounds on the one hand and the complete quantity of other constituents of the initial material, either in a pure state or in a highly concentrated state, as compared with the starting material, on the other hand.

1,389,446. August 30, 1921. **Alloy.** Henry Hecht, of New York, and David G. Black, of Brooklyn, N. Y., assignors to Alloys and Products, Inc., of New York, N. Y.

An object of this invention is to produce an alloy capable of taking a high polish, having a high tensile strength and elasticity, which is non-corrodible and impervious to the action of cold, dilute, or concentrated acids such as sulphuric, tartaric, citric, oleic, oxalic, formic, and other acids as well as alkalis, sea water, and atmospheric influences.

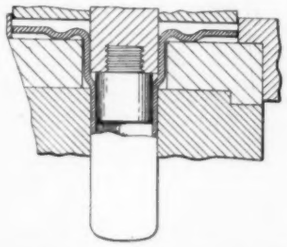
The alloy contains:

Copper	25 to 40%
Nickel	20 to 40%
Chromium	6 to 12%
Iron	25 to 40%

1,389,722. September 6, 1921. **Mold for Plural Castings.** John G. Webb, of Richmond, Virginia.

This invention relates to the art of casting metals and while it has particularly to do with the casting of relatively small ingots of one hundred pounds or less, the apparatus and process are applicable to heavier work.

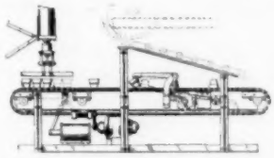
1,389,739. September 6, 1921. **Method of Forming a Pressed Metal Article.** Hjalmar G. Carlson, of Worcester, Mass., assignor by mesne assignments to Rockwood Sprinkler Company, of Massachusetts, a corporation of Massachusetts.



This invention relates to a method of producing from a flat sheet metal blank a tubular article having one end of materially thicker stock than the other, but integral with the tubular portion. Such an article can be formed for any desired purpose.

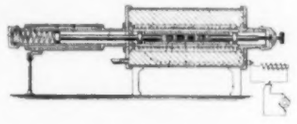
The invention involves the process of gradually producing such an article by a series of cold drawing operations and doubling over its end in dies so as to render the end portion of more than double thickness as described.

1,389,794. September 6, 1921. **Lead-Stacking Machine.** Adolph A. Thiele and John W. Ingersol, of Omaha, Nebraska, assignors to American Smelting and Refining Company, New York.



The invention relates in general to a machine for assembling blocks or bars, which are fed thereto in spaced apart relation, into a compactly positioned stack formed of a plurality of superposed tiers in which the units of each tier are arranged in compact formation. Specifically, the invention relates to a machine for use in a metallurgical plant and is especially designed for receiving the usual elongated frustum of a quadrangular pyramidal form of lead bars delivered from the molding machine, assembling the bars into compactly formed tiers and positioning the tiers in a definite form of stack convenient for ready handling.

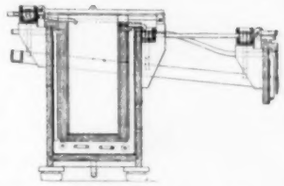
1,390,243. September 6, 1921. **Method of Welding Low-Melting Point Metals and Alloys to High-Melting Point Metals.** Clemens A. Laise, of Weehawken, N. J., assignor by mesne assignments to General Electric Company, of Schenectady, N. Y.



This invention relates generally to a method of welding metals and alloys of metals which have a low melting point to metals and alloys of metals which have a high melting point.

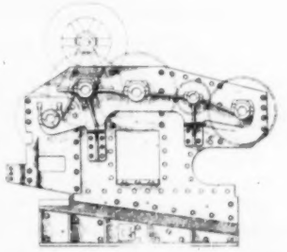
More particularly the invention relates to a method of welding metals such as copper or alloys thereof to tungsten or molybdenum or alloys thereof.

1,389,829. September 6, 1921. **Method of Electrolyzing a Solution of Nickel Salt.** Christian Heberlein, London, England.



The continuous cyclic process for electrolytically producing nickel which consists in electrolyzing a slightly acid liquor containing nickel salt, obtained by treating nickel ore with an acid, and kept in continuous circulation through the cathode compartments of a series of electrolyzing vats in serial order, the insoluble-anode compartments of which vats are traversed by a similar circulating liquor, withdrawing part of said last named liquor as soon as its acidity has exceeded the optimum acidity in the catholyte, and treating fresh nickel ore with said withdrawn liquor to produce further quantities of the first liquor.

1,389,879. September 6, 1921. **Frame for Metal-Cutting Machines.** Hans B. Kraut, of Chicago, Ill.



This invention relates to improvements in frames for metal working machines, such as punching, shearing, bar cutting, section cutting and coping and notching machines, and is herein shown as applied to a frame for a combined punching, shearing, section cutting, bar cutting and coping or notching machine, such as is shown in my companion application for United States Letters Patent filed on the 4th day of March, 1919, Serial Number 280,615.

EQUIPMENT

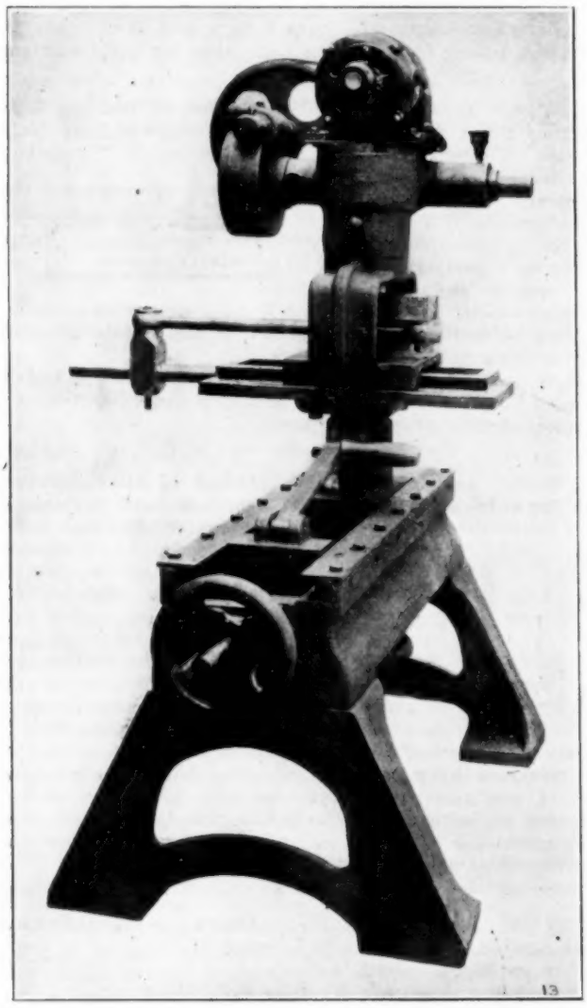
NEW AND USEFUL DEVICES, MACHINERY AND SUPPLIES OF INTEREST

NEW AUTOMATIC BUFFING MACHINE

The enclosed cut shows a new machine recently developed by the Acme Manufacturing Company, No. 1645 Howard Street, Detroit, Michigan—manufacturers of automatic polishing and buffing machinery.

The principle of this machine (or work holder) is that one is placed at each end of the regular buffing lathe the operator standing in the center operates both machines. The operator first places work on the chuck and when the work is brought against the wheel it automatically revolves and strokes back and forth. While one machine is in operation the operator is loading and unloading the one on the opposite end of lathe, in this way affecting continuous operation.

These machines, it is claimed, will increase production at least



NEW ACME BUFFFING MACHINE

fifty per cent over the hand method due to the fact of the more even presure that the machine will give. It is stated that in numerous cases, such as brass shell work, it is sometimes possible to eliminate the polishing operation entirely.

These machines have horizontal and vertical adjustments and swivel head so that the machine can be set up for polishing and buffing the outside of large pans, long shell work, or can be swung at an angle for doing taper work. It can be swung a full ninety degrees for doing such work as the bottom of large pans, discs, canopies, etc., and still use the stroke in this position.

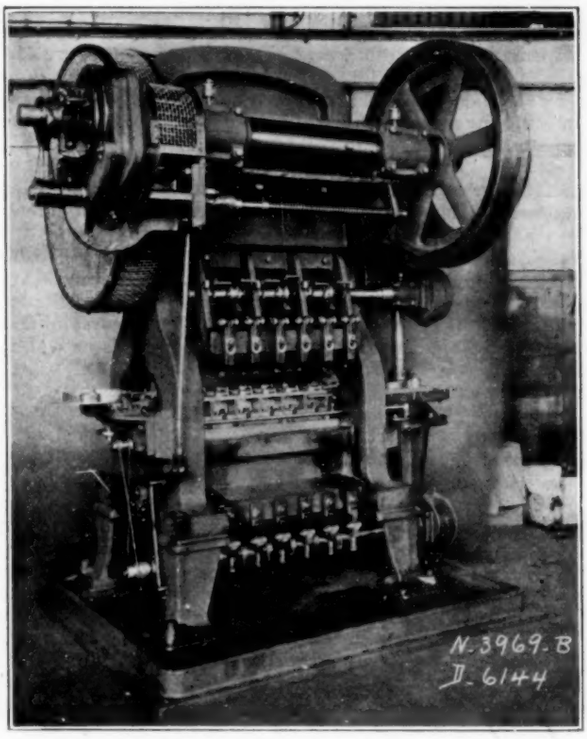
SPECIAL MULTIPLE PLUNGER PRESS

The machine illustrated is one of new design and built by The Waterbury Farrell Foundry & Machine Company, of Waterbury, Conn. It is a Press designed especially for doing multiple operation work similar to that of an Eyelet Machine, except that it is capable of doing heavier stamping and drawing.

It is claimed that as far as known, this is the only machine having separate plungers for each operation that will do heavier work than an Eyelet Machine excepting the Multiple Plunger Presses of the knuckle joint type, which because of their construction are very expensive.

The machine is built for taking the work already cupped, as in a great many cases it is better to cup and draw the work and then anneal it, as the metal can be worked more in this way than would be possible without an intermediate anealing. A four-motion feed makes it possible to pierce holes during successive operations which must register with each other.

In connection with the four-motion feed is a system of upper and lower knock-outs that keep control of the work at all times from the first operation until it is dropped out of the machine.



WATERBURY-FARRELL MULTIPLE PLUNGER PRESS

A friction dial feed is mounted on the outside of the right hand upright and delivers the work to the tools through an opening in the upright. The operator keeps the runway on this dial filled with shells while the press is in operation, the shells passing out of the runway are carried down on incline through an opening in the frame, by positive means to a position in line with the tools, where the main transfer mechanism serving the tools can reach it.

A pair of bars arranged parallel to the tools and having pairs of fingers shaped at their ends to fit the work is given a motion such that at the beginning of the forward movement of the bars the pair of fingers at the feed-in end of the machine grips a shell and carries it to the first working position under the tools. From this point on at each advancing movement of the transfer fingers the shell advances successively to each set of tools and having passed the last set it falls into a chute which conducts it away

from the machine. For each finished piece that falls into the chute a shell is carried into the machine, thus all the tools are kept at work continuously and simultaneously.

The gate connections are of the eccentric adjustment type, an eccentric bronze chankpin bushing being so fixed in the connection that a reasonable shortening or lengthening of the connection can be obtained by loosening the clamping screws on the connection cap and rotating the bushing with a pin wrench. Each transfer finger is independently adjustable. The die bed blocks have a limited amount of adjustment sideways and endways, sufficient to insure the dies lining up with the punches. The strippers and knockouts have independent external adjustments so that their positions relating to the tools can be changed without disturbing the tools.

The machine is equipped with safety devices so that no damage can result should the mechanisms fail to function accurately.

The machine illustrated has a capacity for shells 2½" diameter by 1¾" long. Weight 21,100 pounds. Floor space 71" by 100".

NEW SAND BLAST BARREL

In the city of New York there are probably 125 independent brass foundries, each occupying small space and producing small work. To each of these the cleaning of the output is relatively as great a problem as to the iron and steel foundries. This condition exists to a greater or less extent in other sections. Sand-Blasting has not been possible in these small shops, for no efficient and satisfactory device adapted to small work has been within their demands or means up to this time.

There has just been brought out, however, a sand-blast barrel, which, it is claimed, in size, air consumption and first cost exactly meets the needs of small shops and small work, solves the cleaning problem in many industries.

The device consists of a sheet metal, dust tight, cabinet or housing, on a structural steel frame, the bottom being hoper shape to receive the abrasive, and equipped with a feed box to which is attached a hose that conveys the sand to the nozzle.

The Barrel Drum, mounted within this cabinet or housing is 24" diameter by 16" long, and is constructed of perforated sheet metal, mounted on a shaft at one end, supported in bearings of large size. This shaft is equipped with a gear, engaging a worm (in reduction) on the main driving shaft, which is equipped with tight and loose pulleys and belt shifts. The entire driving mechanism is contained in a cast housing, all outside the cabinet or barrel housing, being integral with the structural frame.

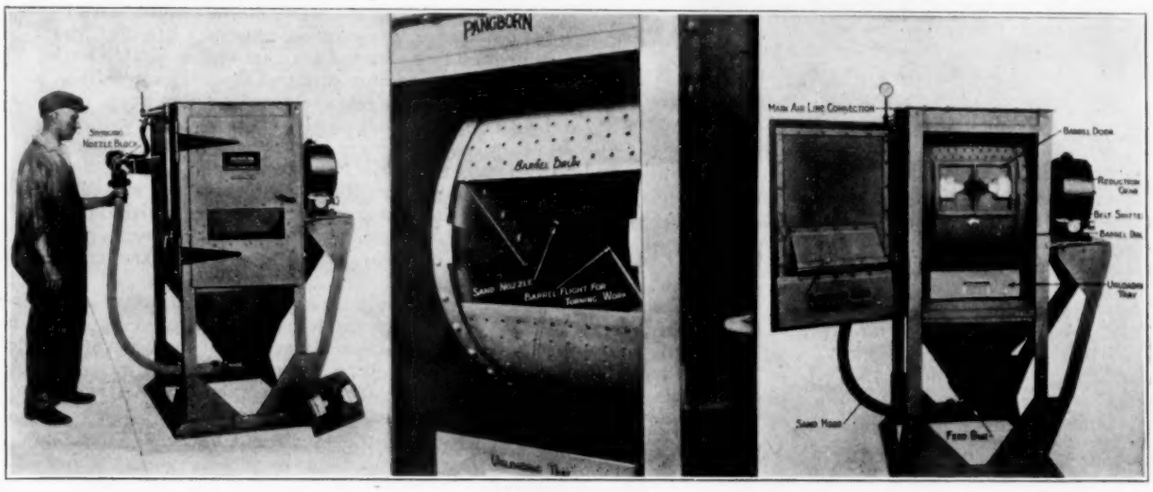
A door the full length of the drum is held in place by a double spring latch. An opening is provided in the top of the Cabinet for attaching to an exhaust system.

Occupying a floor space of 2'7" x 3'6" x 5'6" high, from the illustrations can be seen the relative size and construction of the barrel which is manufactured by the Pangborn Corporation of Hagerstown, Md.

NEW METAL COATING

The Izen Company, 299 Madison Ave., New York, has placed a new metal protecting coat on the market, called Izen. It is stated that Izen is a durable preservative of all metals, and that it prevents tarnish, rust, corrosion and deterioration. It is a colorless, transparent, flexible chemical product, not like shellac, lacquer, or the metal coatings generally used.

The manufacturers recommend Izen for brass, nickel, copper, steel, silver, zinc and any other metals which require protection against rust and tarnish. Izen is not a polish and it is claimed that when applied to polished metals, it eliminates the need of polishing after that; it weatherproofs and waterproofs all metals to which it is applied, so that atmospheric conditions will not affect their lustre.



SAND BLAST BARRELS FOR SMALL FOUNDRIES.

ASSOCIATIONS AND SOCIETIES

REPORTS OF THE CURRENT PROCEEDINGS OF THE VARIOUS ORGANIZATIONS

AMERICAN FOUNDRYMEN'S ASSOCIATION

The city of Cleveland has been selected as the place of the next convention and exhibit of the American Foundrymen's Association, to be held during the week of April 24, 1922. The association headquarters and exhibits will be in the new Cleveland Public Hall, at Lakeside avenue and E. 9th street, which is rapidly nearing completion. The Institute of Metals Division of the American Institute of Mining and Metallurgical Engineers have announced that they will hold joint convention with the association, as has been their custom in years past.

Following an interval of eighteen months, the next meeting promises to be of unusual interest and profit. The Papers Committee advises that manuscript copies are being received and that the first set of preprints of papers to be presented at the convention will be mailed out in January.

BRITISH INSTITUTE OF METALS

A number of very interesting meetings will be held by the local sections. Programs, etc., can be obtained from G. Shaw Scott, 36 Victoria street, Westminster, London, England.

NEW YORK BRANCH A. E. S.

The New York Branch of the A. E. S. held its regular meeting at the Broadway Central Hotel, New York, September 26, 1921, President J. A. Stremel presiding. One application for membership was received, which was referred to the board of trustees. The topics under discussion were nickel plating zinc die cast metal; red precipitate in copper or silver cyanide solutions; turning a brass solution into a copper solution; the use of mercuric dips; silver strikes; silver plating, cracking of brass; zinc plating large bed springs.

PHILADELPHIA BRANCH, A. E. S.

The regular monthly meeting of Philadelphia Branch was held October 7, President Gehling presiding, with a good attendance of members present.

The regular business was put through in short order; after which Supreme President Uhl gave a talk on what the Supreme Body is doing.

The question was asked, "What is a good stop off to coat wheels which had to have a coat of copper, plated on the inside of the bore only?" Paraffine and asphaltum were recommended.

The Banquet Committee reported having made arrangements to hold the annual banquet at the Hotel Lorraine, Broad street and Fairmount avenue, on Saturday, November 19, at 7 P. M., and promises that this will be the best ever. Price per cover $3. Music and dancing.

LIGHTING FIXTURE MANUFACTURERS

That is what lighting fixture makers and dealers, and everyone else who is interested in better lighting—and which of us is not—will be saying from now until January 30, and for a long while afterwards, too.

On January 30, 1922, the National Council Lighting Fixture Manufacturers, the Dealers' Society of American and the Illuminating Glassware Guild will hold their Third Annual Lighting Fixture Market and their Second Joint Convention at the Milwaukee Auditorium.

From January 30 right up to the closing date, February 4, there will be "something doing" every minute. The mornings will most probably be devoted to the Convention meetings and the afternoons to the Fixture Market, just as at the highly successful Fixture Market at Buffalo last February.

In addition to the above-mentioned events there is to be a "Better Lighting Week," to be held during the Convention. Demonstrations of better lighting methods for homes, offices and industrial plants, together with free surveys and reports on improvements possible in existing lighting installations—these and many other features will show the people of Milwaukee the road to more efficient and artistic illuminating.

To all those interested in better lighting the Convention Week at Milwaukee will be full of instruction, amusement and interest—particularly to electrical men. For information write to C. H. Hofrichter, 231 Gordon Square Building, Detroit avenue and West 65th street, Cleveland, O.

INDUSTRIAL TRAFFIC LEAGUE

The Executive Committee of The National Industrial Traffic League, after careful consideration of the transportation problem and the present business and economic situation, is of the belief that the return to normal business conditions requires:

First: Recognition of the fact that efficient and economical operation of the railroads depends primarily on the payment of wages by the railroads no higher than prevail in other lines of industry for similar work.

Second: A general reduction in freight rates equal at least to a decrease in operating expenses brought about by a readjusmtent of wages on a just and equitable basis.

Third: That the carriers should immediately proceed to readjust both wages and rates so that such reductions may take effect simultaneously.

Resolved, therefore, by the Executive Committee of The National Industrial Traffic League that it demand of the railway executives that they abrogate immediately the so-called National Agreements, made effective during the period of Federal control, and which, in its opinion, expired with the return of the railways to private management, and be it further

Resolved, That it demand of the railway executives that wages of railway employees be adjusted upon the basis of wages paid to similar classes of labor in private employment, and simultaneously with such adjustment, a horizontal reduction in rates at least equivalent to the amount of wage reductions be established.

Personals

Fred S. Liscomb, for many years connected with the Western Branch of the Hanson & Van Winkle Company, has resigned to become one of the "Crown Jewels," the second vice-president of the Crown Rheostat & Supply Company, Chicago, Ill. He states that in the future, when in doubt as to the proper methods and equipment necessary to insure production in the electroplating department, "Ask Dad, He Knows."

FRED S. LISCOMB

George L. Sawyer, formerly sales manager of material handling machinery for Barber-Green Company, of Aurora, Ill., has been appointed to represent The Universal Crane Company, Elyria, Ohio. His offices are at the Allied Machinery Center, 141 Center street, New York.

A. E. Ratner, has resigned from the firm of Brile and Ratner, Inc., and has opened an office of his own at 128 Broadway, New York, where he will continue his activities in the metal and chemical business on a commission and brokerage basis.

A. L. Burrows has resigned his position as foreman with the J. F. Langenau Manufacturing Company, of Cleveland, Ohio, manufacturers of trunk and casket hardware and has accepted a position as general foreman of the polishing, buffing and plating departments of the General Graphophone Company, of Elyria, Ohio.

B. F. Tillson, New Jersey Zinc Company, Franklin, N. J., has been elected a vice-president for industrial safety, of National Safety Council.

Coryden P. Karr, metallurgist, Bureau of Standards, Washington, D. C., an authority on metals and alloys, has been made a member of the committee of the National Research Council, that is carrying on investigations of molding sand and foundry refractories.

Mortimer Elwyn Cooley, dean of the College of Engineering and Architecture of the University of Michigan was elected president of the American Engineering Council of the Federated American Engineering Societies.

Ellsworth M. Taylor, 149 Broadway, New York, announces his services to foundries in building up organizations and cost systems.

H. P. Parrock has resigned as general manager of the

Lumen Bearing Company's plants at Buffalo and Youngstown. He remains, however, on the Youngstown directorate. He is engaging in professional work consisting of the design, construction and active operation of foundries, under contract, specializing on the departmental brass foundry and works of a similar nature.

Deaths

JOSEPH WILLIAM RICHARDS

Dr. Joseph W. Richards, head of the Department of Metallurgy at Lehigh University, died at his home in Bethlehem, Pa., October 12, 1921.

Dr. Richards was born in Oldbury, England, July 28, 1864. He was graduated from the Central High School of Philadelphia in 1882 with the degree of Bachelor of Arts, and entered Lehigh University in September of that year. He was graduated from Lehigh University in 1886 with the degree of Analytical Chemist (A. C.). He pursued graduate work at Lehigh University and was awarded the degree of Master of Science (M. S.) in 1891, and of Doctor of Philosophy (Ph.D.) in 1893. He received the degree of Master of Arts (A.M.) from the Philadelphia Central High School in 1887. From 1886 to 1887 Dr. Richards was assistant superintendent of the Delaware Metal Refinery of Philadelphia. In September, 1887, Dr. Richards was appointed assistant instructor in Metallurgy and Blowpiping at Lehigh University, and he served continuously from that time until his death in the following positions: assistant instructor in Metallurgy and Blowpiping 1887-1888; instructor, 1888-1890; instructor in Metallurgy, Mineralogy and Blowpiping, 1890-1897; assistant professor 1897-1903; professor of Metallurgy, 1903-1921.

Dr. Richards was one of the foremost engineers of the country and had an international reputation in various branches of metallurgical technology. His services were widely sought as legal expert in chemical and metallurgical cases. He was a member of the United States Assay Commission 1897; representative of the Franklin Institute to the International Geological Congress held in Russia in 1897; member of the jury of awards, department of Chemistry, of the National Export Exhibition, Philadelphia, in 1899; member of the jury of awards and chairman of the metallurgical sub-jury, Panama-Pacific International Exposition, 1915; member of the United States Navy Consulting Board 1915-1918.

He was a charter member of the Electrochemical Society, its first president, 1902 and 1903, and its secretary since 1907. He was a member of the Franklin Institute, Philadelphia, president of the chemical section 1897-1899, and professor of electrochemistry of the Institute, 1907-1910. He was a member of the Faraday Society, Deutsche Bunsen Gesellschaft, American Chemical Society, American Institute of Mining and Metallurgical Engineers, former vice-president of the Institute and chairman of the Iron and Steel Committee since 1914; member of the Iron and Steel Institute of Great Britain, of the American Iron and Steel Institute, of Societe de la Chimie (France), and of the American Institute of Chemical Engineers; honorary member of the American Electroplaters' Association. He was the representative of the American Institute of Mining and Metallurgical Engineers on the joint conference committee of the federated engineering societies. He was a member of the Board of Engineering Foundation and a member of the National Research Council.

Dr. Richards was a member of the Chemists' Club (New York), and Engineers' Club (Philadelphia), and the Niagara Club (Niagara Falls). He was the author of a work on Aluminum in 1887, the only book on that metal in English; of the revised third edition in 1895 of Metallurgical Calculations Part One, and General Metallurgy in 1906; of Part Two, Iron and Steel in 1907; of Part Three, Non-Ferrous Metals in 1908, also of articles on Metallurgy in Chandler's Encyclopedia, and of many contributions to scientific journals. He was the translator of books from the German and Italian, entitled, "Electrolysis of Water," "Electrometallurgy of Chromium," "Arrangement of Electrolytic Laboratories," "Production of Metallic Objects," "Cementation of Iron and Steel."

Dr. Richards' books on Metallurgical Calculations have been translated into German, French, Italian, Spanish and Russian.

In the early days of the aluminum industry, Dr. Richards interested himself greatly in its advancement, and wrote a number of articles for the Aluminum World, which was the forerunner of THE METAL INDUSTRY. Among these articles were, "Problem of Soldering Aluminum," "Future Prospects of the Metallurgy of Aluminum," "The Use of Aluminum for Coins," and the "Statistics of the Aluminum Industry."

JOSEPH WILLIAM RICHARDS

Dr. Richards was a great chemist, great engineer, and a great teacher. His effect on his students throughout his thirty years of collegian work, to say nothing of his numerous published works, will leave an impression on American metallurgical science, probably stronger than that of any other one man.

JOHN C. BOLAND

John F. Boland, who was for the past eight years employed in the mechanical department of the American Brass Company at Torrington, Conn., and a prominent citizen of that city, died recently at his home 357 Main street, after a serious operation.

JOHN WITTMAN

John Wittman, president Atlas Brass Foundry Co., Columbus, Ohio, died at his home in that city recently from neuritis. He was born in Columbus 65 years ago.

TRADE NEWS

BUSINESS REPORTS OF THE METAL INDUSTRY CORRESPONDENTS

WATERBURY, CONN.

NOVEMBER 1, 1921.

Slowly, but with a decided and wholesome steadiness, Waterbury's metal industry is on the pickup. This opinion is reflected mainly through employment figures given out by the various factories.

"There is nothing sensational in the movement," said one manufacturer recently, "but business on the whole is showing a steady and wholesome improvement and we can see a gradual movement back to better times." Reports from other manufacturers lead to the same conclusion. The **Scovill Manufacturing Company** reported the greatest increase in number of new hands, their total being 400 during the past six weeks, according to Superintendent and General Manager John H. Goss.

Rumored reports of tremendous orders, which would put one of the largest concerns in the city on a full time basis, proved to be unfounded after an inventory of all the local plants had been taken. However, it was learned that a steady increase in business has been taking place practically without exception as to factory or line of business.

The **American Brass Company** has partially opened up several departments which several weeks back were entirely dark. One high official of that company is quoted as saying that the company has been adding hands from time to time and that although the increase has been nothing impressive, it meant a great deal to be following an upward curve instead of downward.

"We have started up some departments that have been idle," said John H. Goss, of the Scovill Company, "and have added about 400 hands in the past six weeks. There is a steady improvement in business noticeable throughout the city. The upward swing has begun."

Frederick S. Chase, president of the **Chase Companies, Inc.**, returned to this city recently from a two months' tour of England and France, where he met his son, Sabin Chase, en route to this country from China. Another son, Rowland, formerly of the 27th Division, was also of the party, and by a strange coincidence their tour of the battlefields brought them to the sector where the 27th was engaged when he was wounded.

In speaking of his trip at the local Rotary Club weekly luncheon, Mr. Chase, himself a Rotarian, said he believed America should cancel the Allied war debts held by this country. He pointed out that France and England had paid such a big price in millions of men and dollars before this country had entered the war that the question of money owed by them to this country is one that should not disturb us, and that it would only be justice for this country to wipe the debt off our books. Mr. Chase also touched on the American Merchant Marine, saying that this country could not begin to compete with other countries in the shipping field without a complete revision of our shipping laws. He pointed out that the cost of operating under the American flag is fully 90 per cent. more than under others, the main causes for this state of things being the present shipping laws and the conditions of employment of the sailors.

Mr. Chase said that, compared with the European countries, the good fortune of our own country is so great as to be impressive.—H. G. N.

TORRINGTON, CONN.

NOVEMBER 1, 1921.

A most encouraging improvement was noted during the past month in general industrial conditions in Torrington. Most of the shops are increasing their working forces and operating on more extended time schedules. The improvement is especially noticeable in those plants affiliated with the metal industry. Taken as a whole, the situation may be viewed with optimism, as there is every indication that the improvement will continue through the fall and winter.

The **Trumbull Vanderpoel Electric Company**, of Litchfield, has filed notice of increase in capital stock from $200,000 to $250,000.

James H. Graham has resigned as general factory manager for the **Torrington Company.** His retirement, it was stated, was necessitated by ill health. Mr. Graham had been associated with the Torrington Company 29 years and had been factory manager for several years.

Lyman B. Comstock, assistant manager of the **Torrington Branch** of the **American Brass Company**, has been appointed a burgess of the borough of Torrington to fill the vacancy caused by the death of **John C. Boland.** Mr. Comstock is widely known among men in the metal industries.—J. H. T.

NEW BRITAIN, CONNECTICUT

NOVEMBER 1, 1921.

Slowly, but steadily and surely, there is a healthy business revival growing right here among the many metal manufacturing concerns in New Britain. With but possibly one exception, each one of the big corporations have seemingly passed the low ebb of business depression, short time and laying off employees, and are now starting in on the upward climb. While the change has come about slowly and is not the result of any sudden boom, it is regarded as a healthy growth that augurs well for the future. The one exception to this rather general statement is the **New Britain Machine Company.** The tractor manufacturing business is admittedly bad and only the very optimistic can see, at present, any glowing future in that line. In the department where machines for factories are made there is a little better business but the main plant is still on short time.

The **American Hardware Corporation** with its several branches—The **P. & F. Corbin Division,** the **Corbin Cabinet Lock Division,** the **Russell & Erwin Division** and the **Corbin Screw Corporation Division**—has ceased to look downward into the depths of depression and is now looking upward toward the heights of stimulated business. The Screw corporation has felt the depression the least of any and continues to maintain a fair business without curtailment of working hours and but a slight cut in the working force. Some departments at the Corbin Cabinet Lock company are actually rushed, this being especially true of the lock departments. Russell & Erwin also has an increased demand for its hardware products. The P. & F. Corbin branch, which was hit probably harder than any of the others, is now picking up and has increased its working schedule in most departments from its low mark of 32 hours per week to a ten-hour working day and a five and a half day week. There seems to be a healthy demand for all kinds of builders' hardware, especially locks, knobs, door and window fasteners, door checks, transom robs etc. In fact it is stated on good authority that business is picking up to such an extent that it now almost rivals that of 1919, before the slump came. The export business is also showing visible signs of stimulation.

The **North & Judd Manufacturing Company,** which has felt the slump as little as any, is rushing along briskly. Not a single dividend has been passed up and the concern has continued as a good investment. At present it is operating near to full capacity.

The **Landers, Frary & Clark Company,** which manufactures a wide range of articles, from simple cutlery to all sorts of silverware, washing machines, vacuum cleaners, vacuum bottles, celluloid articles etc., is also picking up materially after its period of depression. As goods made at this concern are especially in demand during the Christmas holiday seasons, the various branches are operating near capacity to fill the stockrooms for the coming trade.

The **Stanley Works,** especially in its hot and cold rolled steel department, is having plenty of business and the wrought steel butt and hinge business is likely showing im-

provement. The Stanley Rule & Level Company, makers of planes, squares, bit braces, levels, etc., is also doing much better.

The **Skinner Chuck Company,** however, cannot make such encouraging reports. This concern, which closed down completely during the summer, has been compelled to close down again for a two weeks' period, due to lack of business.

A general survey of New Britain's industries at this time shows that the business slump has evidently reached its lowest ebb and the period of gradual return to normalcy is at hand.—H. R. J.

PROVIDENCE, R. I.

NOVEMBER 1, 1921.

The metal trades, second in importance among Rhode Island's industries, have during the past month or six weeks reflected the general business improvement in a slight rise from the extreme depression of the summer. It is estimated to be now operating at about 40 per cent of capacity, as against 25 to 35 per cent before business began a general improvement early in September.

Most of the big plants continue to operate, with working forces reduced far below normal. The **Brown & Sharpe Manufacturing Company,** the largest metal working establishment in Rhode Island and the biggest machine tool factory in the United States, is keeping together its organization and giving work to about 1,500 hands in a part-time schedule. A year ago this plant was giving employment to about 8,000.

The metal trades, jewelry and electrical workers show a radical decrease in the number employed now as compared to a year ago. The metal trades, the survey shows, have about 50 per cent of the employes at work now, as compared with a year ago, and the jewelry industry is only working about 60 per cent of its normal number. The electrical concerns show a decrease of about 40 per cent.

The **Rabuck Company,** of North Attleboro, has been incorporated under the laws of Massachusetts to manufacture, buy, sell and deal in jewelry. The officers of the corporation are as follows: President, R. A. Buckley; vice-president, William French; clerk, Howard V. Foulk, of Cambridge, Mass. The incorporators are the directors.

F. Klein & Company, formerly located at 36 Bromfield street, Boston, have moved their factory to 246 Eddy street, Providence, where they will continue to manufacture gold and platinum hand-made chains.

Markham & Stone, manufacturing jewelers in the Waite-Thresher building, corner Chestnut and Pine streets, are refitting their factory with a line of automatic machines and tools especially adapted for their work.

Macdonald Brothers, electroplaters, who were formerly located on the first floor at 36 Railroad street, Attleboro, have removed their factory to the third floor of the same building.

The **Brass Products Foundry,** 341 Eddy street, Providence, is being conducted by Benjamin T. Peck, according to his statement filed at the city clerk's office.

The **J. J. McCallam Company** has been incorporated under the laws of Rhode Island to manufacture, buy, sell and deal in jewelry with a capital stock of $16,000, divided into 160 shares of common stock of $100 each.

The **Silrose Manufacturing Company, Inc.,** is a new manufacturing jewelry concern that has been incorporated under the laws of Rhode Island with a capital stock of $25,000 in 250 shares of common stock at $100 each.

The installation of Safety guards around all the machinery in the plant of **J. Briggs & Sons Company,** 65 Clifford street, manufacturers of gold rolled plate, wire, etc., is being done by the **What Cheer Wire Works,** of this city.

Stephen Motyka has purchased of **Bernard Smith** the equipment, etc., of the nickel plating business conducted at 69 Slater avenue, Pawtucket, under the name of the **Nickel Plating Company,** and has given a chattel mortgage thereon to **Esther Felman** for $400.

According to information filed at the office of the Providence city clerk, the **Providence Brass Refinishing Company,** 47 Mill street, is owned by Frank G. Lindsay, of Attleboro, and William Carroll, of Rumford.

James S. Heaton has severed his connections with the S. O. S. Welding Corporation, corner Oxford and Devine streets, this city, the local branch of the S. O. S. Welding Corporation of 235 Sixth street, Brooklyn, N. Y.—W. H. M.

ROCHESTER, N. Y.

NOVEMBER 1, 1921.

Dullness continues to prevail in manufacturing circles in Rochester, the one exception being the **Eastman Kodak Plants.** A little improvement in business has been observed during the past month, and about 200 former employees have been restored to positions they were forced to vacate early in September. On that occasion 1,200 employees were laid off indefinitely, owing to dull trade and consequent overproduction.

Reports from the metal-plating plants throughout the city are not of a type that carries encouragement, but it will be interesting to know that there is a sufficient amount of business at hand to keep them running with fairly good forces employed. The settlement of the builders' strike has had a good effect upon the metal trades, inasmuch as a great deal of building has been completed and considerably more started, and the demand for tin, lead, brass and copper has been stimulated.

The **General Railway Signal Company,** of this city, has invented an automatic device by which it is expected collisions on railroads will be prevented in the future. This invention is expected to check possible negligence by an engineer in not seeing signals. It brings about the automatic application of brakes on the locomotive and stops the train within a short distance of the signal thus passed. A successful demonstration of the device was given on the Buffalo, Rochester & Pittsburgh Railroad near Scottsville recently. —G. B. E.

ROME, N. Y.

NOVEMBER 1, 1921.

Business in the brass and copper manufacturing plants of this city is believed to be upward bound, and although no outstanding increase in actual sales has yet developed, old stocks and supplies are practically exhausted, which opens the way for new business.

Bid orders are still rare, but small orders are coming in more or less every day. The whole business machinery seems to be getting under way much like a giant locomotive puffing and snorting on slippery tracks—a labored effort is apparent.

Lack of employment has never reached large proportions in Rome. A few men, generally speaking, have been unable to get work, but the factories,—indeed every employer,—has stood between his men and the jagged reef. Very few families have gone out of town. There has been an interchange of roving laborers, but a rover is a rover. Employment here is picking up now. We are not yet ready to gamble that the existing upward trend is permanent, but they are harboring the hope and belief that it is—M. J. D.

TRENTON, N. J.

NOVEMBER 1, 1921.

Business continues to improve at the Trenton metal plants and the manufacturers are optismic over the prospects for the winter months. The big plant of the **John A. Roebling's Sons Company** is now being operated five days a week in all the departments. The **Jordan L. Mott Company** is now being operated 5½ days a week. It is the first time in many months that conditions have reached normalcy at the plant. The depression struck the works late last winter.

The **Skillman Hardware Manufacturing Company** is being operated fifty hours a week and there is no dull season in sight.

The McFarland Foundry and **Machine Company** expects to continue running full time from now on. Business has also greatly improved at the plant of the **Billingham Brass and Machine Company.**

Residents of New Jersey will be given preference when it comes to employment of skilled and unskilled labor on state work of the Department of Institutions and Agencies. Commissioner Burdette G. Lewis, says that this plan is in keeping

with a determination on the part of the State Board of Control to contribute as far as possible the solution of the employment problem existing in the state. The preference for employing New Jersey residents has been inserted in all the contracts given out by that department. The department issues many big contracts during each year.

The upper stories of the plant of the **Camden Copper Works,** 559 South Second street, Camden, N. J., were recently destroyed by fire, damaging a large quantity of raw and finished stock. Bernard Ahlberg, owner of the plant, said that the loss would be between $15,000 and $25,000. The loss is fully covered by insurance. The plant of the **Strandwitz & Scott,** sheet metal workers, was also threatened for a time. The building will be out into shape again so that there will be no layoff of employees.

William F. Nies, attorney of Newark, who is the receiver of the **Standard Cutlery Company,** of Newark, N. J., is now busy winding up the affairs of that company. Employees of the plant claim wages amounting to more than $3,000. The liabilities of the concern amount to $14,500, while the assets that have so far come under the control of the receiver consist only of the factory equipment, which at a forced sale may bring about $5,000. The company has a plant at 287 Laurel avenue, Newark, and was engaged in the manufacture of scissors.

The **Hulslabder Engraving Company** was one of the Trenton metal concerns to have a novel exhibit at the Trenton fair.

John Hagestrom Company, of South Amboy, N. J., has been incorporated at Trenton with $100,000 capital to deal in metals.

Dalite Lamp Company, of New Jersey, has been incorporated at Trenton with $50,000 capital. The incorporators are Augusta Carell and Warren Dixon, of Jersey City, N. J.

National Light and Electrical Company, of Newark, N. J., has been incorporated with $100,000 capital to deal in electrical supplies.

New Jersey Hardware Company, of Newark, N. J., has been incorporated at Trenton with $100,000 capital to deal in hardware.—C. A. L.

BALTIMORE, MD.

NOVEMBER 1, 1921.

"Fly by night" auction sales of jewelry are prohibited by an ordinance introduced on October 24 in the Second Branch of the City Council by Dr. E. R. Downes and referred to the Committee on Police and Jail. Dr. Downes said the real object of the ordinance is to stop such sales during the Christmas holidays.

The ordinance prohibits the sale at auction at any time of gold, silver or plated ware, precious stones, watches, clocks and jewelry, except by dealers retiring from business. Sales under order of court also are exempted, but it is stipulated that sales by dealers retiring from business must be confined to stocks in their possession one year previous to the sale. These sales shall not continue for a longer period than 30 days.

The penalty for the violation of the ordinance is a fine of $10 for the first offense and $20 for each subsequent offense.

The **Freedom District Electric Light Company,** Sykesville, Carroll County, Maryland, has been incorporated with a capital stock of $5,000 to buy and sell electric fixtures and to buy electric current.

For the manufacture of a patented washer the **Bull Dog Lock Washer Company** has equipped a plant at 269 South Seventh street. The investment in machinery is about $30,000. G. R. Holmes is president and Joseph Verdun secretary-treasurer.

About $25,000 has been invested in the plant of the **American Aircraft, Inc.,** Robert J. Stewart, president. The plant is located at Dundalk and the company will manufacture and assemble their machines there.

The **Hygienic Bottle Cap Company** of Baltimore, Inc., has increased its capital stock to $600,000.

The charter for the **Fowler & Farley Engineering Company,** a $400,000 concern, to manufacture and sell refrigerating and ice machinery, has been filed. The incorporators are E. A. Fowler, A. R. Kassen and C. T. Farley.—W. J. L.

DETROIT, MICH.

NOVEMBER 1, 1921.

Business conditions in Detroit and vicinity within the last thirty days have been slightly better than in the preceding period. But the improvement is not regarded as an indication that the brass, copper and aluminum business is in for any great amount of unusual prosperity. It is just one of those periods of ups that will be followed by a corresponding period of downs, which has characterized business for so many weary weeks.

Improved building conditions are reflected to some extent in a betterment of conditions in the plumbing supply business. While there has been no great rush to speak of, demand for plumbing supplies and building hardware is quite a bit better than it has been for some time. This, however, will be only temporary because the building season is drawing to an end.

Not much has been said regarding stove manufacturing of late. This has been only fair during the summer and at present it too has fallen into the general slump. None of the Detroit stove plants are doing nearly what they should.

Reports from the automobile plants are not so very encouraging just at present. The manufacturing and sales season is drawing to an end and just what is going to happen remains to be seen. Some of the plants are closing entirely. The Ford Motor is only working five days a week now. But we are informed Mr. Ford says he is trying to arrange production so that most of his big force may continue on part time at least throughout the winter.

The threatening railroad strike has scared a great many manufacturers, but this danger seems to be wearing away. However, Detroit manufacturers will be better situated than those in most any other city. They have the Canadian resources to fall back on, and besides Henry Ford has his D. T. & I. line into the southern coal fields which, it is said, will bend every energy to keep the city supplied, not only with fuel, but with other materials necessary to keep the wheels of industry in operation.—F. J. H.

CLEVELAND, OHIO

NOVEMBER 1, 1921.

Wind up of business in the metal industries will be better in the last few weeks of the year than it has been for the last six months, if indeed it is not better than at any time during 1921. This is the consensus of opinion of leaders in big business as a whole, for the simple reason that big business is on the upgrade and has been for the last month or six weeks. Facts and figures, rather than hopes and expectations, bear this out.

Foremost among the improvements is in the building industry, the basic business of the city, as agriculture is the basic industry of the country. Comprehensive efforts have been put forth by the Builders' Exchange and allied institutions to promote building through the winter. It is expected that with these plans in actual operation at least 90 per cent. of the membership of the building trades council, 35,000 members, will be at work. The General Contractors' Association of Cleveland already has asked the mayor to appoint a community conference committee to map out a plan of campaign that will remove obstacles to the building business through the usual dull period. Other businesses are taking a like attitude. More people at work means more people with money to spend. Money spent means better business all around.

The **Mount Eagle Feldspar Company,** a Canadian corporation, has bought the plant formerly occupied by the Meech Foundry Company. The company will manufacture parts used in the electrical industry. Officers of the company are: President, J. O. Brown; vice-president, M. B. Gordon; secretary-treasurer, C. C. Burkett. It was expected the Cleveland plant would be in operation about November 1.

Plant of the **Glenwood Motor Car Company,** of Cleveland will be built at Findlay, according to plans now being considered by officers of the company here. The company has spent three years in developing the product it will build, according to J. B. Cline, president. Plans call for plant with 90,000 square feet at Findlay.

All Canton mills have resumed operation, many of them on a 100 per cent basis, and none on less than 75 per cent basis. New business is responsible for the resumption, officials of several concerns say.

Clearing from the chaos into which the **Standard Parts Company** was thrown some time back is seen in the work of Receiver **Frank A. Scott,** who has made application to the courts to pay another 10 per cent dividend to creditors. Marked reduction in liabilities has been attained the latest report shows. After paying this latest dividend, Mr. Scott asserts there is approximately $1,000,000 in the company's treasury, which, he states is in excess of the working capital. Claims not exceeding $100 are asked to be allowed in full by the company. These amount to less than $23,000.

Fire slightly damaged the plant of the **Murley Tool and Supply Company,** in lower Superior avenue. Firemen kept the flames to waste in the basement, where the fire started.

C. C. C.

LOUISVILLE, KY.

NOVEMBER 1, 1921.

The sheet copper workers are finding business mighty slow at the present time, the total volume of this business handled in Louisville just now being insufficient to keep one fair shop even half-way busy. Most of the plants are down and running spasmodically, whenever a little business can be had.

In the foundry trade business is somewhat better; that is, in castings, as a few industrial concerns are placing orders for castings, and shops handling such work report fair to good business. A good many companies which use any quantity of cast goods are operating their own shops, and the total volume of such business let out to trade shops is not heavy, and has to be handled at a relatively low margin of profit to prevent the buying company from putting in its own casting shop.

Railroad demand is better for raw material, as railroads not being able to handle enough car repairs through independent shops are now working full forces in car repairs. The Louisville & Nashville R.R., at Louisville, is running its brass shop at full speed in turning out journals for cars, locomotives and brass parts used in its engine and car building shops.

Active building operations this season have resulted in the brass and enameled divisions of the **Standard Sanitary Manufacturing Company,** at Louisville, being operated on a very excellent schedule for some months past. The plant has been enlarged materially the past five years, several improvements being made during the past year. Plumbing shops are all busy on a large volume of small orders.

The **Independent Brass Foundry** reports some good work for electrical switching devices, laundry machinery, mill machinery and a little marine work, the shop having been good and busy.

The **Vendome Brass & Copper Co., Ahlers & Gregoire Company** and the **Matt Corcoran Company** are all finding business slow and are operating spasmodically.

Hines & Ritchey report that the **Standard Milk Machinery Company** is busy, and that this is taking most of the concern's attention. The company some years ago cut out casting work, and Hines & Ritchey merely do a little foundry work for the Standard Milk, which is owned by the same interests.

—A. W. W.

MONTREAL, CANADA

NOVEMBER 1, 1921.

There is still a slight improvement noted in the non-ferrous metal industries here. Some of the shops have slightly increased their working schedules, though there has been no change in the number of workers employed.

Prices on metal goods are now back to normal and this has been the cause of bringing more business to the manufacturers.

The Board of Trade and Town Council of the city of Brockville, Ont., have ratified an agreement entered into with the **Eugene F. Philips Electrical Works, Ltd.,** of Montreal, whereby the concern, reputed to be the largest in the British overseas Dominions engaged in the manufacture of copper electric wire and cable, will locate its main plant at Brockville, Ont. Congestion at the Montreal establishment is said to be responsible for the transfer of the works to Brockville, where a site of 132 acres is provided.

The company plans to erect a plant costing between $2,500,000 and $3,000,000 to give employment in normal times to between 500 and 600 hands, with an estimated annual payroll of $500,000. Between 1,000 and 3,000 horsepower is to be consumed by the company, which will secure its power from the Hydro. This consumption of power will cut in two the power rates for all local consumers. A fixed assessment of $20,000 on all lands and buildings for a period of ten years is granted to the company, which undertakes to commence work on a rolling mill, the first unit, within three months.

Another new brass manufacturing concern has been incorporated this month under the name of the **Alliance Brass Manufacturing Company.** The men at the head of this new concern are all practical men connected with one of the leading brass concerns here. It is capitalized at $75,000 and will be located at Peterboro, Ont. They have secured a site and building and expect to commence manufacturing by January 1.—P. W. B.

BIRMINGHAM, ENGLAND

OCTOBER 18, 1921.

Very little progress has been made during the past month in the non-ferrous metal industries of the country. Unemployment is so serious in all trades that Parliament has re-assembled to consider a scheme upon which the Cabinet and Government departments have been at work for some weeks past in consultation with representatives of industrial, commercial and financial interests. The Labour Party has held aloof, in spite of repeated invitations to co-operate, but has consented to send deputations who have had one or two interviews with ministers. The scheme, it is understood, will combine methods for the immediate mitigation of distress by relief works and an extension of the period of National Unemployment benefit, with plans for the improvement of export trade and the encouragement of manufacture.

The great factor in the situation is the state of the exchanges and the absence of credits in export markets. Many suggestions have been made, but the manner in which the Government will attempt the solution of the difficulty has not been revealed. It is believed, however, that an extension to other countries of the financing of export business adopted for certain markets last year will form part of the scheme.

Meantime the metal trades, which can only afford full employment when export business is normal, continue for the most part in the condition in which they were a month ago. Most of the export business done by brassfounders is with Australia and New Zealand. This trade after promising extension fell off again, but a few good orders have recently been received, probably as the result of labour troubles in Australia. In cabinet brassfoundry there is little doing either for home or for export, the home trade suffering from the lack of building enterprise. Contract rolling mills are getting a little more work. The silver and electroplate trades have improved as the result of seasonal demands, but orders are far below their usual bulk. Jewelers upon the whole continue very poorly employed though one or two houses report a fair amount of business. What improvement has occurred has been chiefly in the cheaper line. In most of the hardware trade an improvement in business with South America has been experienced.

High wages, a low rate of output per worker and the heavy cost and low quality of fuels are amongst the things which handicap efforts for the reduction of selling prices to such a level as to enable business to be obtained in face of German and other Continental competition. There has been a substantial though not a sufficient reduction in coal prices, and the miners are showing a greater readiness to meet owners who declare that without an increase of output and cleaner coal their collieries will have to close.

A new spelter plant is being installed by a European continental firm in Indo-China and **William Johnson & Sons** (Leeds) Limited have received the contract for a complete plant for the manufacture of retorts, condensers, etc., including appliances for dealing with refractory clays, chemotts, etc., also hydraulic press with pump, accumulators and accessories for the production of retorts. Messrs. Johnson who obtained the contract against keen German competition, equipped several new spelter works in Great Britain during the war.—H.

VERIFIED NEWS OF THE METAL INDUSTRY GATHERED FROM SCATTERED SOURCES

The **Anaconda Copper Mining Company** has begun the experimental manufacture of copper shingles and brass shingle nails in an effort to broaden the commercial use of copper.

The **Illinois Zinc Company,** 280 Broadway, New York, is showing pictures of recently erected houses having zinc shingle roofs.

It is rumored that the **Anaconda Copper Mining Company** is trying to buy controlling interest in the **American Brass Company.** No confirmation or denial can be obtained from either company.

The **Dayton Aluminum and Manufacturing Company,** Dayton, Ohio, have increased their capital from $10,000 to $50,000. This company operates spinning, stamping, polishing and lacquering departments.

The **Williams and Anderson Company,** 23-33 Broad street, Providence, R. I., are erecting a one-story factory of 16,000 square feet, for manufacturing a line of emblematic specialties, in gold, silver, rolled plate and electro plate.

The **L. Rosenfeld Manufacturing Co.,** Russell and Ostend streets, Baltimore, manufacturer of utensils for dairy and ice cream plants, plans to erect a factory, 40 x 125 ft. Louis Rosenfeld is president. The company's capital has been increased from $10,000 to $75,000.

The **Michael's Art Bronze Company,** 220 Scott street, Covington, Ky., has awarded a contract to George Scheper, 52 John street, Covington, for a four-story addition to its plant, 45 x 65 ft., estimated to cost about $45,000. Construction will commence at once. F. L. Michael is head of the company.

The **J. W. Paxson Company,** 1021 North Delaware avenue, Philadelphia, Pa., manufacturer of foundry equipment, has filed plans for a new one-story building at Algon Avenue and Luzerne Street, to cost about $35,000. They operate boiler, machine, forge, electric welding and pattern departments.

The **A. P. Swoyer Company's** stock of merchandise, at 17 North Seventh street, Philadelphia, has been purchased by the **U. T. Hungerford Brass and Copper Company,** 510 Arch street, Philadelphia, and the premises have been leased by them. Possession was taken by the Hungerford company September 1.

The **Armour Institute of Technology,** Chicago, Ill., was honored at the annual meeting of the Fire Underwriters Association of the Northwest, held at Chicago, October 5th, by the gift of a large bronze tablet in commemoration of the emiment service rendered in the cause of fire prevention by the late President, Dr. Frank W. Gunsaulus.

The **Smithville Metals, Ltd.,** Smithville, Ont., will erect a new factory to cost $11,000. The steel contract has been let to the Standard Steel Construction Company, Welland, Ont. The Smithville Company operates a brass, bronze and aluminum foundry, brass machine shop, grinding room, and plating, polishing, japanning and lacquering departments.

The **Neenah Brass Works,** Neenah, Wis., has acquired a half interest in the manufacture of a refuse incinerator, invented by John B. Ranz, of Neenah, which they plan to produce in quantities. The device can be made to meet the varying requirements of dwellings, hotels, hospitals, etc. The company operates a brass, bronze and iron foundry.

The **Hoskins Manufacturing Company,** Detroit, Mich., manufacturer of electric furnaces, etc., has filed plans for a one-story addition to the top of its plant, 60 x 190 feet. This addiitonal floor is to be used in the manufacture of resistance wire of the finer sizes. They have a foundry making nickel-chromium alloys, and a rolling mill. H. B. Walker is president.

The **Trumpbour-Whitehead Brass and Copper Company, Inc.,** Canal and Mercer streets, New York City, has been appointed exclusive Eastern distributor of monel metal products for the International Nickel Company. They are already carrying a stock of monel sheet, rod, shot, billet and ingots in their New York and Boston warehouses, and plan to carry a stock in Philadelphia.

Beginning with the issue of October 24th, **Commerce Reports,** the Government's official foreign trade publication, issued weekly by the Department of Commerce, will have an artistic cover. The Department of Commerce is of the opinion that the new cover is a distinct innovation and that this is probably the first instance in the history of Government publishing that anything of this kind has been attempted.

The **Electric Welding and Manufacturing Company,** 145 Clinton street, Milwaukee, Wis., has changed its name to the Welded Products Manufacturing Company, Oscar Greulich is president and George F. Luehring secretary and treasurer. The company manufactures factory and shop equipment such as trucks, stools, racks, elevating truck platforms, bench legs, portable work benches, warehouse trucks, stools and chairs.

The **New Haven Sherardizing Company,** of Hartford, Conn., will move its subsidiary, the **Middlesex Machine Company,** Bridge street, Middletown, Conn., to Hartford, where it will be operated in connection with the plant at 868 Windsor street. The Middlesex Company manufactures the Connecticut universal grinding machine and special machinery. They operate a tool room, grinding room, and polishing department.

The **Wireless Vacuum Cleaner Company,** Book Building, Detroit, Mich., has been organized to manufacture vacuum cleaners. Production is being carried on in temporary quarters, but negotiations for a factory are nearing completion. The officers are W. S. Richards, president; F. D. Siebert, vice-president; F. W. Edward, treasurer, and A. F. Stryker, secretary. They operate an aluminum foundry and plating and polishing departments.

The **Pennsylvania Foundry Supply Company,** Philadelphia, has been organized to act as manufacturer, dealer and agent for all kinds of supplies and equipment for foundries making ferrous and non-ferrous castings. It is the Eastern distributor of the Mac Company, Milwaukee, Wis., for parting, high temperature furnace cement, brass cleaner and core compound. H. E. Mandel, formerly of the Lindsay Chaplet and Manufacturing Company, is general manager.

The **Forbes Aluminum Products Company,** Easton, Pa., recently organized with a capital of $4,500,000, is planning for the erection of a factory, the initial unit to give employment to about 400. The company is represented by the Corporation Trust Company of America, Du Pont Building, Wilmington, Del. The company operates a rolling mill, tool room, stamping and lacquering departments. They have established headquarters at 38th street and Fifth avenue, New York.

The **Metal Products Manufacturing Company,** 561 W. Lombard street, Portland, Ore., has been incorporated with a capital of $100,000, and are preparing to erect a new modern plant factory, for the manufacture of cast aluminum cooking utensils, novelties, etc. The building plans have been completed and approved by the board of directors. Commencement of actual construction will take place in approximately two or three weeks. They are in the market for up-to-date machinery and equipment and will be glad to look over all lines.

The **Alexander Milburn Company,** Baltimore, Md., has received two large contracts for oxy-acetylene welding and cutting equipment from the Baltimore and Ohio Railroad and the Western Maryland Railroad. The contracts call for a number of Milburn "Cut-Weld" combination cutting and welding torches. These torches can be transformed instantly from the cutting to the welding type by merely changing the tip. The Milburn Company operates a brass machine shop, tool room, stamping, brazing, soldering, polishing and lacquering departments.

The **Drop Head Projector Company,** Fond du Lac, Wis., manufacturer of portable motion picture machines, has increased its capitalization to $750,000, consisting of $700,000 common and $50,000 preferred stock. The company has been reorganized and is preparing to engage in quantity production. The contract for dies and die castings has been placed with the Doehler Die Casting Company, Brooklyn, Chicago and Toledo. The Drop Head Projector Company

operates a tool room, grinding room, stamping, brazing, soldering, polishing and lacquering departments.

The **National Cash Register Company,** Dayton, Ohio, has increased its capitalization from $15,000,000 to $30,000,000. The increase was made in the company's second preferred stock, which was raised from $5,000,000 to $20,000,000. Stock will be offered to present holders of first and second preferred stock, as an exchange issue. Officials of the company state that the issue is not to provide for extensions to the Dayton plant, as none are contemplated at the present time. There will be, however, approximately $10,000,000 of the new issue left that will be available for expansion if such a course is ultimately decided upon.

The name of the **Advance Platers' Supply Company,** 125-127 West Illinois street, Chicago, Ill., has been changed to the **Advance Wheel Manufacturing Company,** to conform with a change in the policy of the concern, which has discontinued the jobbing of platers' and polishers' supplies in general and will devote all of its energies hereafter to the manufacture of polishing wheels. A complete line of canvas, muslin, cloth, sheepskin, bullneck, walrus, and wood wheels will be manufactured. No change takes place in the personnel of the organization. James J. Manderscheid continues as general manager and Alexander H. Stutz as sales manager.

Surface Combustion Company, Inc., 366 Gerard avenue, Bronx, New York City, announces that it is now represented in all the principal European countries, where it has made many large industrial furnace installations. The Compagnie Generale de Construction de Fours, 32-34 Rue de la Grange-aux-Belles, Paris, France, is the sole licensee and manufacturer for the Surface Combustion Company's apparatus in France and its colonies and Belgium, Holland, Switzerland, Italy, Spain and Portugal. British Furnaces, Ltd., Millbank House, 2 Wood street, London, S. W. 1, England, organized in July, manufactures and sells the Surface Combustion Company's apparatus in the British Empire.

The complete findings of the survey made by the **Special Libraries Association** have recently been published in the form of a "Special Libraries Directory," edited by Dorsey W. Hyde, Jr., president of the Association, Mills Building, Washington, D. C. In so far as is known, this Directory represents the first attempt at a comprehensive study of American business information sources. The increasing importance to the industrial executive of accurate facts and information is illustrated by the rapid growth of industrial research libraries, with trained library experts in charge. As the result of the survey, over 1,300 special libraries were discovered, and of this number more than 200 are concerned directly with industrial and manufacturing subjects.

The **Hardinge Company,** 120 Broadway, New York City, has acquired the Pulverized Fuel Department of the **Quigley Furnace Specialties Company.** The Hardinge Company states there will be no change in the method of conducting the business at their offices, as the organization of the engineering department has been taken over practically intact. The experience and manufacturing facilities of the Hardinge Company enables them, with their present equipment and augmented staff, to further extend the activities of the Quigley Pulverized Fuel System. The rapid growth of the refractory specialties business (high temperature cement and insulation) has made it advisable for the Quigley Company to devote their entire attention to this branch of their work, which will be continued as heretofore.

The **Electric Furnace Company,** Alliance, Ohio, has just exported two of its electric melting furnaces to England. Both of these units are of the rolling mill type, arranged for direct pouring of the metal into molds. Johnson-Matthey & Company, Ltd. of London, England, purchased a 50 K. W. Nose Tilting furnace, with hydraulic tilting mechanism—this furnace is 500 pounds hearth capacity, and is to be used for melting silver bullion. Allen Everett & Sons, Ltd., Birmingham, England, have ordered a 125 K. W. Nose Tilting type furnace, and this furnace has 2,000 pounds hearth capacity, and is tilted by means of a motor-operated mechanism. This is the second "Baily" electric furnace to go into service in the oldest rolling mill in England, the first furnace being used for melting pure copper, and the second furnace for melting 60-40 brass.

The **R. Hardesty Manufacturing Company,** 1833 Market Street, Denver, Colo., manufacturer of metal products, cans, etc., is completing plans for two additions, both one-story, 100 x 160 ft. and 120 x 160 ft. respectively, estimated to cost $90,000, including machinery. C. S. Lambie, Tramway Building, is architect and engineer. The company operates a tool room, galvanizing anr soldering department in conjunction with its factory.

The **Williams & Anderson Company,** 33 Broad Street, Providence, R. I., manufacturer of emblems and other metal goods, has awarded contract to Bowerman Brothers, Industrial Trust Building, for a new one-story plant on North Main Street, 60 x 160 ft., with extensions, 60 x 100 ft., estimated to cost about $65,000. The company operates a tool room, grinding room, plating, polishing, lacquering, soldering, stamping and rolling departments.

The employees of the **Mueller Metals Company,** Port Huron, Mich., have voluntarily agreed to accept a ten percent cut in wages. The cut applies to officials as well as employees.

British Government's Scrap Deal

Reported to The Metal Industry by Our British Correspondent.

Metal merchants in England are protesting angrily against the sale of the whole of the remaining stock of Government scrap brass to the British Metal Corporation, Limited. The quantity is said to be about 200,000 tons, and the approximate average price £20 a ton. It is believed that the bulk of the material is crushed shell cases, a 70-30 mixture which at the time of the announcement commanded at least £45. Shell bands, a certain quantity of which is probably included in the deal, sold last year at £100, and at present are worth £60 to £63, whilst 60-40 brass ingots, of which there must be a fair quantity, are worth £36. Metal merchants, who are already overloaded with stocks bought at higher than present market prices, contend that the Disposals Board should have adhered to the rule that all sales of surplus material should be open to public tender. They claim that the recognized members of the trade could have handled the business with greater profit to the country, and, in view of the services they rendered during the war, should have been given the opportunity of buying parcels of metal which would have enabled them to average their existing stocks. A public inquiry into the transaction is being demanded, and the matter will probably be brought before Parliament. In reply to a message of protest from the Birmingham section of the trade, sent when the first rumor of the deal got abroad, the Disposals Commission replied: "It is regretted that no offer has been received from yourselves."

The explanation in reply is that in June, 1920, when market prices were much higher, applicants were referred by the Disposals Board to a Birmingham firm which, it was stated, had acquired the whole of the Government's stocks. At that time the market price for the constituent metals was much higher. The stock was then stated to include 5,000 or 6,000 tons of copper shell bands, upwards of 30,000 tons of brass cartridge shell cases, 30,000 tons of brass ingots, and many thousands of tons of other brass scrap and of antimonial lead bullets. The trade is anxious to know whether this contract was finally completed, and, if so, why there is such a large tonnage for disposal now.

Some of the directors of the British Metal Corporation were connected with the Ministry of Munitions or with the Disposals Board. It is naturally suggested that they must have had a good deal of inside knowledge not available to the trade, and were probably better informed as to the outcome of the reported sale last year, whilst the trade believed that there was no more metal in Government hands for sale. "One can hardly help feeling," says a leading Birmingham merchant, "that an undue preference has been given to them." A number of other questions will be

raised if a public inquiry takes place. For instance, there was a report a fortnight ago that 1,000 tons of antimonial lead for which a firm in London had offered £19 a ton was being shipped to Germany at £16.

No marked effect on the quotations on the London Metal Exchange was produced by the deal. The report that 100,000 tons of the scrap was to be shipped to America for conversion into copper no doubt had a certain steadying influence. Merchants, however, have already suffered considerable loss of business. An order usually placed at this time of year with a Birmingham firm for 1,000 tons of brass has been withheld, and many other purchasers are holding back in the expectation of cheapening as the result of the operations of the corporation. Some substantial sales of sheet brass have recently been made to India, and the buyers, having seen the announcement of the Government deal, are now complaining of the price. Bankruptcy as the result of the depreciation of their stocks is feared by many merchants. It is declared that the scrap sold for £4,000,000 is worth between £7,000,000 and £8,000,000, if valued at the current market price. Early last year an offer of £95 for scrap at Woolwich was declined, those responsible expecting to get a better market by waiting. When the slump began, considerable sales were made to merchants and others, but as the market continued to fall those purchases in many cases were sold at a loss.

Charles Vincent Sale, the chairman of the purchasing company, states that the bulk of the 200,000 tons of scrap is in Great Britain, but a considerable quantity is still in France. The payment of the £4,000,000 will be completed within the present financial year; that is, by the end of March. He and his company, he says, have plans for the disposal of the metal, but it is too early to talk of them publicly. "There is," said Mr. Sale, "a steady demand for brass even in the present condition of our industries, and our chief source of supplies of copper and zinc—the constituents of brass—is the United States of America. In view of the present state of the exchange as between London and New York, the fact that this purchase represents metal already in this country is important, since the payment of the considerable sum of £4,000,000 will not affect the value of the pound sterling in America, whereas the purchase direct from the United States of the equivalent tonnage represented in copper and zinc would have tended to depress the rate of exchange."

In justification of the deal, statements such as the following have been put forward: "It will relieve the copper market from the competition of second-hand metal, and permit of an expansion in the demand for new copper which will be welcomed by the producers in the United States. Incidentally this should at least assist in a revival of the London copper market. The fact that the stocks are now in the hands of commercial men who have had a lifetime experience, not only in the British metal trades but also in the international trade, should be a source of stability to the metal trades."

BUSINESS TROUBLES

Robert N. Gilmore, receiver for the **Mott Sand Blast Company, Inc.,** bankrupt, has petitioned the Eastern District Court of New York for discharge from his duties.

A special meeting of the creditors of the **Philadelphia Brass Company,** bankrupt, will be held on November 9th at the Federal Building, 9th and Chestnut streets, Philadelphia.

W. A. Randall, president of the **Randall-Faichney Company, Inc.,** has sent out a letter to the creditors and stockholders of that company, explaining its conditions.

A voluntary petition in bankruptcy was filed in Buffalo on September 22 by the **Coates Bennett & Reidenbach Company,** of this city. Liabilities were listed at $297,669.60 and assets at $392,601.79. The concern deals in scrap iron and steel and has been one of the largest of its kind in the country. Frederick W. Reidenbach, vice-president of the company, is considered an authority on scrap metal and was a member of the National Reclamation Board for the Federal government during the war. In discussing the causes for the bankrupt condition of this firm, William MacFarlane, attorney for the concern, says the government dumped about $2,000,000 worth of metal on the market, causing the bottom to drop out. Business was at a standstill and the Rochester firm was hard hit. Before making an application, the company offered its creditors forty cents on the dollar. A few declined to accept the tender, with the result.

Bankruptcy has captured two Louisville, Ky., concerns which consumed numerous bronze and brass castings, and one of the local casting shops was hurt just a little by these failures. One of these was the Shuler Axle Manufacturing Company, manufacturers of auto axles, the company buying bronze castings for rear assemblies; and the other was the Visible Measure Gasoline Dispenser Company, manufacturers of gasoline measuring pumps for filling stations, which consumed quantities of special hose connections, nozzles, pump parts, etc.

RESPIRATORS TO BE INVESTIGATED

An investigation of the various types of respirators used by workers in numerous industries in preventing the inhalation of injurious dusts is to be undertaken at the Pittsburgh, Pa., experiment station of the United States Bureau of Mines.

The tests to be made by the Bureau of Mines will be conducted by S. H. Katz, assistant physical chemist, and L. J. Trostel, junior chemist, under the direction of A. C. Fieldner, supervising chemist.

ALUMINUM COINS

The Bank of France has begun the distribution of 20,000,000 francs in new bronzed aluminum coins which are to replace the paper money issued last year by the Chamber of Commerce and which was condemned by the Health Board as unsanitary.

Although the public is rejoicing over these new coins, economists are calling attention to the danger to France's small silver reserve, which, already greatly diminished by international speculation, may be still further reduced by boiling down the present silver coins which offers a chance for 5 per cent. profit if the person making the conversion is not detected.—New York Herald.

CIVIL SERVICE POSITIONS

Examinations are announced for the positions of Metallurgist, Associate Metallurgist, Assistant Metallurgist and Junior Metallurgist in the Bureau of Mines. Applicants should apply for Form 2118, which can be obtained from the Civil Service Commission, Washington, D. C., of local post offices and custom houses.

CHEAP ALUMINUM SPOONS

Aluminum spoons of German manufacture are being sold in New York for five cents. A year ago, similar spoons of American make sold as high as fifty cents.

TRADE PUBLICATIONS

Emblems.—A catalogue issued by the Williams & Anderson Company, Providence, R. I., illustrating the line of society and other emblems which they manufacture.

Hoyt Metal Company.—A booklet just issued by the Hoyt Metal Company, St. Louis, Mo., describes the products of lead and tin, etc., produced in their rolling mill and pipe departments.

The **Schoop Metal Spraying Process.**—A booklet issued by the Metals Coating Company of America, 495-497 No. Third street, Philadelphia, Pa., describing and illustrating the Schoop spraying process of metal coating, and explaining the principles and apparatus used.

Research Narratives No. 18. Direction by Two Ears.—A folder issued by the Engineering Foundation, 29 West 39th street, New York City.

Research Narrative No. 19. Whittling Iron.—A folder issued by the Engineering Foundation, 29 West 39th street, New York City.

Spraying, Air Compressing and Exhaust Equipment.—The Eureka Pneumatic Spray Company, Inc., of 62 Ninth Avenue, New York City, has just issued a handsomely illustrated descriptive catalogue of the above equipment.

Forge Furnaces. Bulletin No. 239.—A bulletin issued by W. S. Rockwell Company, 50 Church street, New York, describing and illustrating their forge furnaces for use with drop hammers, etc.

Chain Furnace Screens.—A pamphlet isued by E. J. Codd Company, 700 South Caroline street, Baltimore, Md., describing and illustrating their curtains of chain for covering furnace openings during operations, to prevent heat losses.

Modern Cutting and Grinding.—A booklet issued by the Oakley Chemical Company, 22 Thames street, New York City, describing their lubricating compounds for use in cutting and grinding operations.

Ulco Lead Wool.—A booklet issued by the Hoyt Metal Company, St. Louis, Mo., describing and illustrating their lead wool rope for calking pipe joints, etc.

Grinding and Polishing Machines.—Several folders issued by the St. Louis Machine Tool Company, 932 Loughborough avenue, St. Louis, Mo., describing and illustrating new types of ball bearing grinding machines.

The **Continuous Heat-Treatment of Metals with Automatic and Semi-Automatic Furnaces.**—Bulletin No. 234, issued by W. S. Rockwell Company, 50 Church street, New York City, containing a paper illustrating the practical applications of principles governing production of heat-treated products, with much information about the various types of furnaces used for this work.

Tube Welding Machinery and Fabricating Equipment.—A catalogue issued by the Davis-Bournonville Company, Jersey City, N. J., describing and illustrating a complete line of tube welding and fabricating equipment, and briefly describing the procedure.

Analysis and Testing of Impurities in Caustic Soda.—Technical Bulletin No. 7, published by Solvay Process Company, Syracuse, N. Y., dealing with testing of caustic soda.

What Industrial Engineering Includes.—A paper-bound book published by C. E. Knoeppel & Company, New York, industrial engineers, which defines the field of this profession, and furnishes a reference to industrial executives from which they can quickly analyze and ascertain complete information as to the scope of industrial engineering. It outlines the divisions of service which the Knoeppel Company maintains and the results obtainable through them. The whole is carefully and completely indexed; a very interesting book.

Year Book 1921 of the Merchants' Association of New York.—Issued by the Merchants' Association, 233 Broadway, New York City, containing the reports of the officers and committees, a plan of organization, by-laws and lists of members of the association.

Trucks and Tractors.—A booklet issued by the Lakewood Engineering Company, Cleveland, U. S. A., which illustrates the applications of industrial trucks and tractors.

Technical Books of 1920.—A catalogue of books on technical subjects compiled by the Pratt Institute Free Library, Brooklyn, N. Y.

Depreciation.—A pamphlet issued by the Fabricated Production Department of the Chamber of Commerce of the United States, containing a report on the investigation of depreciation of manufacturing equipment, made by the department, and offering suggestions in regard to this problem.

METAL STOCK MARKET QUOTATIONS

	Par	Bid	Asked
Aluminum Company of America	$100	$400	$450
American Brass	100	188	198
American Hardware Corp	100	139	142
Bristol Brass	25	12½	15
International Nickel, com	25	13¼	13¾
International Nickel, pfd	100	71	75
International Silver, com.	100	30	40
International Silver, pfd	100	82	87
New Jersey Zinc	100	125	127
Rome Brass & Copper	100	115	135
Scoville Mfg. Co	100	290	315
Yale & Towne Mfg. Co	..	235	245

Corrected by J. K. Rice, Jr., & Co., 36 Wall Street, New York.

METAL MARKET REVIEW

Written for The Metal Industry by W. T. Partridge

October 1, 1921

COPPER

Developments in the copper industry during the past month were encouraging commercially and statistically. Domestic consumers seemed inclined to cover requirements for the remainder of the year and foreign consumers, while they bought less than in September, because of the large amount of British war scrap that became available, still made quite satisfactory purchases in the second half of the month.

Estimates of the total outgo from all ports indicated, approximately 35 to 40 million pounds. Producers' stocks of refined copper are now being reduced at an average monthly rate of about 30 million pounds. The outlook at the end of the month was for continued improvement in consumption.

Prices of both Lake and electrolytic in the outside market advanced ½c. a pound, net, and casting ¼c. a pound net, during the month. Producers' prices of electrolytic advanced ¼c. a pound on late positions and ⅜c. to ½c. a pound on nearby shipments. Producers' closing prices were 13c. delivered for electrolytic prompt, November and December shipments; lake 13c. to 13.25c. delivered for nearby shipments, and casting copper 12.50c. delivered, for prompt and November. Outside closing levels were, Lake 13-13.25c. delivered, for nearby shipments; electrolytic was stronger at 12.87½c. f. o. b. refinery for prompt and November, 13c. f. o. b. refinery for December, and 13.12½c. f. o. b. refinery for first quarter 1922. Casting copper was steadier at 12.37½c. to 12.50c. f. o. b. refinery for prompt and November.

TIN

The course of sterling exchange, which advanced sensationally in October was the most important factor governing prices of tin during the month. Price fluctuations covered a range of 1¾c. per pound, from the lowest levels, October 4th, 26.87½c. for Straits, 26.75c. for American pure and 26.50c. for 99% tin to the highest levels October 21, 28.62½c. for both Straits and American pure and 28.12½c. for 99% metal. The net result, however, from the opening, 26.87½c. for both Straits and American pure, 26.62½c. for 99% metal, to the closing 28.25c. for Straits, 28.25c. for American pure and 27.75c. for 99% metal was an advance of 1⅜c. on Straits and American pure and 1¼c. on 99% tin.

LEAD

While activity in the lead market continued throughout October, there was undoubtedly a slowing down in demand during second fortnight, largely due, it was thought, to general conditions. Up to that time, the movement was reported steady, with a very satisfactory volume of specifications on contracts with producers. The leading interest made no change in its basis, 4.70c. East St. Louis and New York during the month.

In the outside market, closing levels were 4.40-4.45c. East St. Louis, 4.70-4.75c. New York on prompt; the net result of changes being a decline of 10 points in the East St. Louis level and no change at New York or, in the basis of the leading interest.

ZINC

The better tone and higher prices ruling in the zinc market during the closing week of September, were reflected in the October opening at 4.50c. East St. Louis, 5.00c. New York for prompt primary, with five points premium asked on each succeeding month's delivery. Activity increased as the stronger tone was developed and prices advanced almost daily to the highest levels, 4.65-4.70c. East St. Louis, 5.15-5.20c, New York for prompt on October 17; remaining at these levels until October 21, when because of the expected railroad labor strike and the probability of shipments not

getting through before it developed, there was a cessation in activity and the market quieted down, with occasional shading in prices thereafter. On the last day of the month prices were 4.55-4.60c. East St. Louis, 5.05-5.10c. New York, showing a net use of five points.

ALUMINUM

Conditions and prices in the aluminum market were unchanged during the month until October 13, when the weakness so long apparent developed into unsettlement under the influence of renewed selling pressure in the outside market. Sales on that day, of foreign ingots, were reported at 17c. f. o. b. New York. Good round tonnages could undoubtedly have been done for even less had there been sufficient interest. Quotations were then marked off 1.00c. per pound to 17-18c. for 98-99% virgin; 16-17c. for 98.99% remelted, and 14-15c. for No. 12 remelted, these prices still prevailing at the end of the month. The Aluminum Company of America reported good business at the time of the reduction in outside prices and made no change in its schedule, 25c. for 99% and purer, 24.50c. for 98-99% virgin, 24c. for No. 12 alloy during the month. On October 25, however, the company announced a reduction of 4.10c. on sheets to 35c. for 18ga. and heavier flat, and to 30c. for 18ga. and heavier coil.

ANTIMONY

The advance in prices of antimony that began during the closing days of September carried on to 5.00-5.25c. on October 4, from the lowest, 4.45c. duty paid New York for carloads reached in the month before. The most active buying of the year was in evidence, but with fresh arrivals in considerable volume offered at concessions and selling pressure in some quarters, prices gradually were carried back to 4.80c. on October 26.

SILVER

The price of foreign bars in October opened at an advance of ⅛c. to 70⅞c. per ounce. Fluctuations thereafter, carried to 73⅝c. October 17, the highest of the year, and then declined to 68⅝c. on October 25. The net result was a decline of ⅛c. the closing being 70¾c. per ounce.

QUICKSILVER

Lack of demand and plentiful supplies of quicksilver during first three weeks of October caused a decline in prices to $38-40 per flask of 75 pounds each on October 14, but with reversed conditions in supply and demand developing thereafter, there was a recovery to $40-41 per flask on October 31.

PLATINUM

After opening at the September closing $78 per troy ounce for pure, there was a total advance of $7 per ounce to $85 per ounce on October 27, under the influence of continued steady demand and decreasing supplies.

OLD METALS

Striking improvement in activity early in October verified expectations of the trade expressed in late September.

By the end of month, demand was less active, with copper, new brass sheet clippings, aluminums, lead and type scraps leading. Net advance in the list were ½c. on light copper to 8c., strictly crucibled to 10.50c., light brass to 4.75c. No brass turnings to 4.50c., special heavy to 6.75c., composition scrap to 8c., cocks and faucets to 6.50c., old cast aluminum to 9.50c., clean hand picked shells to 3c., new type shell cuttings to 7.50c. and stereotype to 4.25c. Advances of 1c. were netted on new brass clippings to 6c. and on No. 1 pewter to 15c. a pound, while aluminum clippings were up ¾c. to 12.50c. A rise of ¼c. was made on uncrucibled copper to 9.50c. and on heavy brass to 5c., on new zinc scrap to 2.75c., heavy led to 3.75c., tea lead to 2.75c. and clean red car boxes to 6.50c. a pound.

SEPTEMBER MOVEMENT IN METALS

	Highest	Lowest	Average
Copper:			
Lake	12.50	12.00	12.232
Electrolytic	12.25	11.87½	12.104
Casting	12.00	11.50	11.75
Tin	27.37½	26.00	26.732
Lead	4.70	4.40	4.606
Zinc (brass special)	4.62½	4.25	4.343
Antimony	5.00	4.45	4.529
Aluminum	20.00	18.00	19.024
Quicksilver (per flask)	$45.00	$39.00	$42.167
Silver (cts. per oz.) Foreign	.71⅝	.62½	66.15

OCTOBER MOVEMENT IN METALS

	Highest	Lowest	Average
Copper:			
Lake	13.25	13.50	13.012
Electrolytic	13.00	12.37½	12.753
Casting	12.62½	12.12½	12.431
Tin	28.62½	26.87½	27.744
Lead	4.55	4.40	4.466
Zinc (brass special)	4.70	4.50	4.614
Antimony	5.25	4.80	4.937
Auminum	19.00	17.00	17.85
Quicksilver (per flask)	41.00	38.00	39.575
Silver (cts. per oz.) foreign	.73⅝	.68⅝	70.97

WATERBURY AVERAGE

Lake Copper.—Average for 1920, 18.06—January, 1921, 13.75—February, 13.50—March, 12.625—April, 12.75—May, June, 5.00—July, 4.80—August, 4.70—September, 4.75—Octo- 12.375—October, 13.125.

Brass Mill Zinc.—Average for 1920, 8.33—January, 1921, 6.05—February, 5.50—March, 5.25—April, 5.20—May, 5.30—June, 5.00—July, 4.80—August, 4.70—September, 4.75—October, 5.10.

Metal Prices, November 7, 1921

NEW METALS

Open Market

	Cents
COPPER—DUTY FREE. PLATE, BAR, INGOT AND OLD COPPER.	
Manufactured 5 per centum.	
Electrolytic, carload lots, delivered	13c.
Lake, carload lots, delivered	13 -13¼c.
Casting, carload lots, delivered	12½c.
TIN—Duty free.	
Straits, carload lots	27⅞c.
LEAD—Duty, Pig, Bars and Old, 25%; pipe and sheets, 20%. Pig, carload lots	4.70-4.75
ZINC—Duty 15%.	
Brass Special	5.20-5.25
Prime, Western, carload lots	5.10-5.15
ALUMINUM—Duty, Crude, 2c. per lb. Bales, sheets, bars and rods, 3½c. per lb.	
Small lots, f. o. b. factory	.....
100-lb. f. o. b. factory	.....
Ton lots, f. o. b. factory	17-25
ANTIMONY—Duty 10%.	
Cookson's Hallet's or American	Nominal
Chinese, Japanese, Wah Chang WCC, brand spot	4.80
NICKEL—Duty, Ingot, 10% ad valorem. Sheet, strip, strip and wire, 20%.	
Ingot	41.00
Shot	41.00
Electrolytic	44.00
MANGANESE METAL—95-98% Mn., carbon free, per lb. Mn. contained	0.75
MAGNESIUM METAL—Duty 20% ad valorem (100 lb. lots)	$1.25-1.35
BISMUTH—Duty free	1.50-1.55
CADMIUM—Duty free	1.00-1.25
CHROMIUM METAL—95-98% Cr., per lb. Cr. contained	1.50
COBALT—97% pure	Nominal 3.00-3.25
QUICKSILVER—Duty 10% per flask of 75 lbs.	40.00-41.00
PLATINUM—Duty free, per ounce	$85
SILVER—Government assay—Duty free, per ounce	.99¼
GOLD—Duty free, per ounce	20.67

Metal Prices, November 7, 1921

INGOT METALS

Silicon Copper, 10%	according	to	quantity	34 to38
Phosphor Copper, guaranteed 15%	"	"	"	16⅛to28¾
Phosphor Copper, guaranteed 10%	"	"	"	15⅞to27⅞
Manganese Copper, 30%	"	"	"	50 to56
Phosphor Tin, guarantee 5%	"	"	"	35⅝to45⅝
Phosphor Tin, no guarantee	"	"	"	37 to48
Brass Ingot, Yellow	"	"	"	8 to10
Brass Ingots, Red	"	"	"	11 to13
Bronze Ingot	"	"	"	11½to13½
Parsons Manganese Bronze Ingots	"	"	"	16½to18
Manganese Bronze Castings	"	"	"	24 to33
Manganese Bronze Ingots	"	"	"	13 to16
Manganese Bronze Forgings	"	"	"	30 to40
Phosphor Bronze	"	"	"	24 to30
Casting Aluminum Alloys	"	"	"	18 to21
Monel Metal	"	"	"	38

OLD METALS

Buying Prices		Selling Prices
9¾to10¼	Heavy Cut Copper	11¼to11½
9½to10	Copper Wire	11 to11¼
8 to 8½	Light Copper	9½to10
8½to 9	Heavy Machine Comp.	10½to11
6 to 6½	Heavy Brass	7½to 8
4½to 5	Light Brass	6 to 6½
5 to 5½	No. 1 Yellow Brass Turnings	6 to 6½
7 to 7½	No. 1 Comp. Turnings	8½to 9
3½	Heavy Lead	4
3½	Zinc Scrap	4
4½to 5	Scrap Aluminum, Turnings	6½to 7½
10 to11	Scrap Aluminum, cast alloyed	12 to13
13 to14	Scrap Aluminum, sheet (new)	15 to16
18	No. 1 Pewter	22
14½	Old Nickel anodes	16½
22½to24½	Old Nickel	26½to28½

Prices nominal—No market.

BRASS MATERIAL—MILL SHIPMENTS

In effect Sept. 1, 1921

To customers who buy 5,000 lbs. or more in one order.

	Net base per lb.		
	High Brass.	Low Brass.	Bronze.
Sheet	$0.16¼	$0.17¾	$0.19
Wire	0.16¾	0.18¼	0.19½
Rod	0.14¼	0.18¾	0.20
Brazed tubing	0.25	....	0.29¾
Open seam tubing	0.25	....	0.29¾
Angles and channels	0.30	....	0.34¾

To customers who buy less than 5,000 lbs. in one order.

	Net base per lb.		
	High Brass.	Low Brass.	Bronze.
Sheet	$0.17¼	$0.18¾	$0.20
Wire	.17¾	.19¼	.20½
Rod	.15¼	.19¾	.21
Brazed tubing	.26	....	.30¾
Open seam tubing	.26	....	.30¾
Angles and channels	.31	....	.35¾

SEAMLESS TUBING

Brass, 18c. to 19c. per lb. base.

Copper, 20½c. to 21½c. per lb. base.

TOBIN BRONZE AND MUNTZ METAL

Tobin, Bronze Rod	18¾c. net base
Muntz or Yellow Metal Sheathing (14"x48")	16¼c. " "
Muntz or Yellow Rectangular Sheets other than Sheathing	17¼c. " "
Muntz or Yellow Metal Rod	14¼c. " "

Above are for 100 lbs. or more in one order.

COPPER SHEET

Mill shipments (hot rolled)	20½c.-21½c. net base
From stock	21½c.-25¾c. net base

BARE COPPER WIRE—CARLOAD LOTS

14¾c. to 15c. per lb. base.

SOLDERING COPPERS

300 lbs. and over in one order	18¾c. per lb. base
100 lbs. to 300 lbs. in one order	19¾c. per lb. base

ZINC SHEET

Duty, sheet, 15%. Cents per lb.

Carload lots, standard sizes and gauges, at mill, 10c. basis less 8 per cent. discount.

Casks, jobbers' prices	11c.-12½c.
Open casks, jobbers' prices	11c.-13c.

ALUMINUM SHEET AND COIL

Aluminum sheet, 18 ga. and heavier, base price	39c.
Aluminum coils, 24 ga. and heavier, base price	33½c.

NICKEL SILVER (NICKELENE)

Base Prices

Grade "A" Nickel Silver Sheet Metal

10%	Quality	26¼c. per lb.
15%	"	28¾c. " "
18%	"	29½c. " "

Nickel Silver Wire and Rod

10%	Quality	28c. per lb.
15%	"	32¼c. " "
18%	"	35c. " "

MONEL METAL

Shot	35
Blocks	35
Sheet Bars	40
Hot Rolled Rods (base)	42
Cold Drawn Rods (base)	56
Hot Rolled Sheets (base)	55

BLOCK TIN SHEET AND BRITANNIA METAL

Block Tin Sheet—18" wide or less. No. 26 B. & S. Gauge or thicker, 100 lbs. or more, 10c. over Pig Tin. 40 to 100 lbs., 15c. over 25 to 50 lbs., 17c. over, less than 35 lbs., 25c. over.

No. 1 Britannia—18" wide or less. No. 26 B. & S. Gauge or thicker, 500 lbs. or over, 8c. over N. Y. tin price; 100 lbs. or more, 10c. over Pig Tin. 50 to 100 lbs., 15c. over, 25 to 50 lbs., 20c. over, less than 25 lbs., 25s. over. Above prices f. o. b. mill.

Lead Foil—base price—figured on base price of lead at the time.

Platers' metal, so called, is very thin metal not made by the larger mills and for which prices are quoted on application to the manufacturer.

SILVER SHEET

Rolled silver anodes .999 fine are quoted at from 73½c. to 75c. per Troy ounce, depending upon quantity.

Rolled sterling silver, 70½c. to 73c.

NICKEL ANODES

85 to 87%	purity	.45c. per lb.
90 to 92%	"	.47½c. per lb.
95 to 97%	"	.50c. per lb.

Supply Prices, November 7, 1921

CHEMICALS

In Commercial Quantities

Acid—		
Boric (Boracic) Crystals	lb.	.14
Hydrochloric (Muriatic) Tech., 20 deg., Carboys	lb.	.02½
Hydrochloric, C. P., 20 deg., Carboys	lb.	.08
Hydrofluoric, 30%, bbls	lb.	.08
Nitric, 36 deg. Carboys	lb.	.07
Nitric, 42 deg. Carboys	lb.	.07¼
Sulphuric, 66 deg., Carboys	lb.	.02½
Alcohol—		
Denatured in bbls	gal.	.45
Alum—		
Lump, Barrels	lb.	.04
Powdered, Barrels	lb.	.05
Aluminum sulphate, commercial tech	lb.	.02½-.03
Aluminum chloride solution	lb.	.20
Ammonium—		
Sulphate, tech., Barrels	lb.	.04
Sulphocyanide	lb.	.50
Argols, white, see Cream of Tartar	lb.	.30
Arsenic, white, Kegs	lb.	.07
Asphaltum	lb.	.35
Benzol, pure	gal.	.40
Blue Vitrol, see Copper Sulphate.		
Borax Crystals (Sodium Biborate), Barrels	lb.	.05½
Calcium Carbonate (Prescipitated Chalk)	lb.	.05
Carbon Bisulphide, Drums	lb.	.07½
Chrome Green	lb.	.40-.45
Cobalt Chloride	lb.	—
Copper—		
Acetate	lb.	.48
Carbonate, Barrels	lb.	.18
Cyanide	lb.	.63
Sulphate, Barrels	lb.	.05¾
Copperas (Iron Sulphate, bbl.)	lb.	.02½
Corrosive Sublimate, see Mercury Bichloride.		
Cream of Tartar, Crystals (Potassium bitartrate)	lb.	.27
Crocus	lb.	.15
Dextrin	lb.	.05-.08
Emery Flour	lb.	.06
Flint, powdered	ton.	$30.00
Fluor-spar (Calcic fluoride)	ton	$75.00
Fusel Oil	gal.	3.25
Gold Chloride	oz.	14.00
Gum—		
Sandarac	lb.	.30
Shellac	lb.	—
Iron, Sulphate, see Copperas, bbl	lb.	02½
Lead Acetate (Sugar of Lead)	lb.	.12-.13
Yellow Oxide (Litharge)	lb.	.09
Mercury Bichloride (Corrosive Sublimate)	lb.	.68
Nickel—		
Carbonate Dry	lb.	.50-.55
Chloride, 100 lb. lots	lb.	.30-.40
Salts, single, bbls	lb.	.12
Salts, double, bbl	lb.	.10¾
Paraffin	lb.	.07-.10
Phosphorus—Duty free, according to quantity		.25-.30
Potash, Caustic, Electrolytic 88-92% fused, drums	lb.	6½
Electrolytic, 70-75% fused	lb.	.10
Potassium Bichromate, casks	lb.	.12½
Carbonate, 80-85%, casks	lb.	.07
Cyanide, 165 lb. cases, 94-96%	lb.	.45
Pumice, ground, bbls	lb.	.05
Quartz, powdered	ton.	$30.00
Official	oz.	—
Rosin, bbls.	lb.	.03½
Rouge, nickel, 100 lb. lots	lb.	.20
Silver and Gold	lb.	.60
Sal Ammoniac (Ammonium Chloride) in casks	lb.	.07
Silver Chloride, dry	oz.	.86
Cyanide	oz.	—
Nitrate, 100 ounce lots	oz.	.47
Soda Ash, 58%, bbls	lb.	.03
Sodium—		
Biborate, see Borax (Powdered), bbls	lb.	.05½
Bisulphate, tech., bbls	lb.	.03½
Cyanide, 96 to 98%, 100 lbs	lb.	.30-.32
Hydrate (Caustic Soda) bbls	lb.	.04½
Hyposulphite, kegs	lb.	.04
Nitrate, tech. bbls	lb.	.04½
Phosphate, tech., bbls	lb.	.06
Silicate (Water Glass) bbls	lb.	.03
Sulpho Cyanide	lb.	.60
Soot, Calcined	lb.	—
Sugar of Lead, see Lead Acetate	lb.	.12-.13
Sulphur (Brimstone) bbls	lb.	.03
Tin Chloride	lb.	.40
Tripoli	lb.	.03½
Verdigris, see Copper Acetate	lb.	.48
Water Glass, see Sodium Silicate, bbls	lb.	.03
Wax—		
Bees, white ref. bleached	lb.	.55
Yellow, No. 1	lb.	.21
Whiting, Bolted	lb.	.02½-.06
Zinc, Carbonate, bbls.	lb.	.08
Chloride, 600 lb. lots	lb.	.10-.12
Cyanide	lb.	.46
Sulphate, bbls.	lb.	.03½

COTTON BUFFS

Open buffs, per 100 sections (nominal).

12 inch, 20 ply, 64/68, cloth	base,	$39.40
14 " 20 " 64/68, "	"	49.00
12 " 20 " 84/92, "	"	43.70
14 " 20 " 84/92, "	"	58.90
Sewed buffs, per pound		
Bleached and unbleached	"	.45

FELT WHEELS

Diameter		Price Per Lb. Less Than 100 Lbs.	100 to 300 Lbs.	300 Lbs. and Over
6" to 24"	½" to 1"	$3.50	$3.40	$3.25
10" to 16"	1" to 3"	2.50	2.40	2.25
6" to 24"	Over 3"	2.90	2.80	2.65
6", 8" and over 16"	1" to 3"	2.60	2.50	2.35
4" to 6"	¼" to 3"	4.50	Any quantity	
Under 4"	¼" to 3"	5.10	Any quantity	

Grey Mexican or French Grey—10c. less per lb. than Spanish.